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THEATER OF OPERATIONS DENTAL WORK LOAD ESTIMATION

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## TABLE OF CONTENTS

	Page
Report Documentation Page . . . . .	i
Table of Contents . . . . .	ii
List of Tables . . . . .	iii
Acknowledgements . . . . .	v
Chapter 1 - INTRODUCTION . . . . .	1-1
1.1 PURPOSE . . . . .	1-1
1.2 BACKGROUND . . . . .	1-1
1.3 DEFINITIONS . . . . .	1-2
1.4 METHODOLOGY . . . . .	1-3
Chapter 2 - LITERATURE REVIEW . . . . .	2-1
2.1 DENTAL EMERGENCY WORK LOAD . . . . .	2-1
2.2 MAXILLOFACIAL WORK LOAD . . . . .	2-2
2.3 MAINTAINING AND SUSTAINING WORK LOAD . . . . .	2-4
Chapter 3 - DENTAL EMERGENCIES DURING A MILITARY FIELD EXERCISE . . . . .	3-1
3.1 INTRODUCTION . . . . .	3-1
3.2 METHODOLOGY . . . . .	3-2
3.3 FINDINGS . . . . .	3-4
3.4 DISCUSSION . . . . .	3-5
Chapter 4 - DENTAL DATA BASE AND MODEL . . . . .	4-1
4.1 DENTAL CONDITIONS . . . . .	4-1
4.2 RATES OF OCCURRENCE . . . . .	4-2
4.3 SIMULATION . . . . .	4-2
4.4 DISCUSSION . . . . .	4-13
4.5 RECOMMENDATIONS . . . . .	4-13
Chapter 5 - DISCUSSION . . . . .	5-1
5.1 RECOMMENDATIONS . . . . .	5-3
APPENDIX A - CONDITION LIST . . . . .	A-1
APPENDIX B - DISTRIBUTION LIST . . . . .	B-1

LIST OF TABLES

TABLE	PAGE
2-1 ANNUAL RATES OF DENTAL EMERGENCIES PER 1000 NAVY-MARINE PERSONNEL IN VIETNAM AND NON-VIETNAM LOCATIONS, 1969-1970 . . . . .	2-7
2-2 ANNUAL RATES PER 1000 NAVY-MARINE PERSONNEL FOR DIAGNOSTIC CATEGORIES OF DENTAL EMERGENCIES IN VIETNAM AND NON-VIETNAM LOCATIONS, 1969-1970 . . . . .	2-8
2-3 ARMY DENTAL SERVICE EXPERIENCE, EXERCISE DESERT STRIKE, 15 FEB - 29 JUN 1964, CONDITIONS SEEN, BY CATEGORY. . . . .	2-9
2-4 ARMY DENTAL SERVICE EXPERIENCE, EXERCISE DESERT STRIKE, 15 FEB - 29 JUN 1964. . . . .	2-10
2-5 PRIMARY DIAGNOSES FROM 360 EMERGENCY DENTAL PATIENTS OVER 39 DAYS . . . . .	2-11
2-6 TREATMENTS RECEIVED BY 360 SOLDIERS REPRESENTING 438 PATIENT VISITS OVER 39 DAYS . . . . .	2-12
2-7 MEDICATIONS RECEIVED BY 360 SOLDIERS. . . . .	2-13
2-8 DISTRIBUTION BY RANK OF 351 DENTAL EMERGENCY PATIENTS . . . . .	2-14
2-9 FREQUENCY OF SICK CALL VISITS, BY THE CONDITIONS WHICH CAUSED THE VISITS IN TRAINING EXERCISES AT FORT IRWIN, CA 1981 . . . . .	2-15
2-10 FREQUENCY OF TREATMENT RENDERED FOR CONDITIONS WHICH PRESENTED ON DENTAL SICK CALL, IN TRAINING EXERCISE AT FORT IRWIN, CA 1981. . . . .	2-16
2-11 DISPOSITION OF DENTAL SICK CALL PATIENTS AFTER TREATMENT IN TRAINING EXERCISES AT FORT IRWIN, CA 1981 . . . . .	2-17
2-12 RANK AND SEX DISTRIBUTION OF SICK CALL GROUP AND CONTROL GROUP IN DENTAL RECORD AUDIT, US ARMY P.D./FIELD SICK CALL STUDY, 1981. . . . .	2-18
2-13 INCIDENCE OF DENTAL EMERGENCIES BY PRESENTING DIAGNOSES . . . . .	2-19
2-14 FREQUENCY OF TREATMENT RENDERED FOR DENTAL EMERGENCIES. . . . .	2-20
2-15 TYPES OF FACIAL BONES FRACTURED IN 1,096 PATIENTS IN IRHA . . . . .	2-21
2-16A SITE OF SOFT TISSUE INJURY AS A PERCENT OF INJURY TYPE. . . . .	2-22
2-16B TYPE OF SOFT TISSUE INJURY AS A PERCENT OF INJURY SITE. . . . .	2-22
2-17 DISPOSITION OF 2,795 IRHA PATIENTS WITH MAXILLOFACIAL INJURIES. . . . .	2-23
2-18 SITE OF 237 MANDIBULAR FRACTURES NOT CAUSED BY MISSILES . . . . .	2-24

LIST OF TABLES (CONTINUED)

TABLE	PAGE
2-19 RATES OF MAXILLOFACIAL INJURIES IN A TYPICAL THEATER. . . . .	2-25
2-20 US ARMY DENTAL PATIENT VISITS IN VIETNAM, 1968-1973. . . . .	2-26
2-21 DISTRIBUTION AND RATE OF DENTAL PROCEDURE UTILIZATION IN HEALTH SERVICES COMMAND FY82 (580,375 TROOPS SUPPORTED). . . . .	2-27
3-1 FREQUENCY AND DISTRIBUTION OF DENTAL EMERGENCY VISITS AT FIXED AND FIELD DENTAL FACILITIES, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-9
3-2 RANK DISTRIBUTION OF DENTAL EMERGENCY VISITS, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-10
3-3 AGE DISTRIBUTION OF DENTAL EMERGENCY PATIENTS, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-11
3-4 RACE DISTRIBUTION OF DENTAL EMERGENCY PATIENTS, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-12
3-5 SEX DISTRIBUTION OF DENTAL EMERGENCY PATIENTS, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-13
3-6 TIME DISTRIBUTION OF DENTAL EMERGENCY VISITS EXERCISE CARBINE FORTRESS, 1982. . . . .	3-14
3-7 PRIMARY, ADDITIONAL, AND ALL DIAGNOSES FOR DENTAL EMERGENCIES, EXERCISE CARBINE FORTRESS, 1982 . . . . .	3-15
3-8 TREATMENTS RENDERED FOR PRIMARY DIAGNOSES, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-16
3-9 TREATMENTS RENDERED FOR ADDITIONAL DIAGNOSES, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-17
3-10 TREATMENTS RENDERED FOR ALL DIAGNOSES, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-18
3-11 DISPOSITION OF SOLDIERS AFTER DENTAL EMERGENCY VISITS, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-19
3-12 PRIMARY DIAGNOSES FOR PATIENTS REQUIRING EVACUATION, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-20
3-13 COMPARISON OF FIELD AND FIXED FACILITY TREATMENT, EXERCISE CARBINE FORTRESS, 1982. . . . .	3-21
3-14 COMPARISON OF THE DIAGNOSES AT FIELD AND FIXED FACILITIES, EXERCISE CARBINE FORTRESS, 1982 . . . . .	3-22
5-1 DENTAL EMERGENCY RATES' IMPACT ON UNIT EFFECTIVENESS. . . . .	5-4

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## CHAPTER 1

### INTRODUCTION

#### 1.1 PURPOSE

The purpose of this project was to describe dental work load in a theater of military operations in a form useful to either manual or computerized simulation.

#### 1.2 BACKGROUND

The military has a tradition of combat scenario simulation to provide information for planning. Modern management technologies have popularized the use of simulation as an instrument of planning, and the military has enthusiastically accepted the power of computerized simulations. Concepts Division (CD) and Operations Analysis Office (OAO) of the Directorate of Combat Developments (DCD), Academy of Health Sciences, US Army have developed a computerized data base of information on various elements of medical support in a theater of operations. This medical data base is used in a series of computerized simulation models to address medical resource requirements, capabilities, and facilities design and use in a typical theater of operations.<sup>1</sup>

The only medical conditions included in the data base which require dental resources are maxillofacial wounds, and these wounds are defined for the data base in a way which is open to wide interpretation as to what resources are required for treatment. For any medical support data base to be complete, more than just maxillofacial injuries need to be included in the dental portion of the data base. There is a need for information on all dental conditions which require dental resources in a theater of operations. To conduct simulations which yield credible results, the data which are used as the basis for this type of analysis must be a reflection of real experience.

In a theater of operations, the term, "dental work load" means work which must be accomplished to minimize the interference of dental disease and injury with the accomplishment of the military mission. A complete analysis of dental work load should include work areas such as clinical dental work, forensic dental identification, civic action programs, treatment of prisoners of war, dental laboratory services, medical/dental equipment maintenance, medical/dental supply, combat casualty care, and personnel services which are provided by dental detachments in the theater. This paper limits its considerations to clinical dental work carried out at unit, area, and hospital levels of support in the theater.<sup>2</sup> Clinical dental work is dependent on the frequency of occurrence of dental emergencies, maxillofacial injuries, and on the amount of sustaining and maintaining dental services which must be provided in order to preserve the oral health and thus the fighting strength of troops. It is only adequate to support the military mission.

### 1.3 DEFINITIONS

It is the opinion of the authors that future efforts in the area of dental simulation and epidemiologic studies would profit by the standardization of some terminology. Conducting this study required that dental terminology be defined. The following definitions are offered, as a minimum, to help understand this report, and possibly as a study outcome which will be useful to continuing effort in work load simulation.

**CLINICAL DENTAL WORK** is the procedures and tasks which must be accomplished in order to treat or prevent dental and oral disease and injury. Dental procedures and tasks are named by the Defense Code on Dental Procedures and Nomenclature listed in Army Regulation 40-182, dated 1 Oct 1983.

**DENTAL CONDITIONS** are the oral or dental diseases, injuries, anomalies, and situations which are regarded as pathologic, dysfunctional, or cosmetically unacceptable. In the absence of any dental condition, a person would be in optimal dental and oral health. A list of definitions of dental conditions was formulated by a modified Delphi procedure. The Delphi group consisted of 18 dental officers, including each of the dental consultants to the US Army Surgeon General. See Appendix.

**DENTAL EMERGENCY** is an acute episode of a dental or oral condition which becomes painful or threatens to become systemically debilitating. In a military setting the definition is expanded to include conditions which the patient genuinely perceives to be severe enough to cause him to leave his duty station to seek treatment. If a soldier leaves his duty station he becomes a casualty. It does not include deliberate malingering. **DENTAL EMERGENCY CARE** must be provided as the most austere level of dental support in order to directly and immediately return fighting troops to duty.

**MAXILLOFACIAL INJURY** is a category of dental conditions which are caused by trauma to oral tissues, perioral tissues, mid-face, and/or jaws. Minor maxillofacial injury does not require the services of a specialist in oral and maxillofacial surgery, is considered part of **DENTAL EMERGENCY CARE**, and can be treated at dental facilities. **MAXILLOFACIAL CARE** is for major maxillofacial injury or disease which is severe enough to require the services of a specialist in oral and maxillofacial surgery. It is primarily carried out at a hospital and is part of the total medical work load addressed by medical planners.

**SUSTAINING DENTAL CARE** defines a level of expedient dental services which intercepts potential emergencies in a theater of operations in order to minimize the time lost to troops engaged in combat operations. This level of care is essential to the minimal preservation of the fighting strength early in the conflict.

**MAINTAINING DENTAL CARE** describes the level of definitive dental services which prevent and treat dental and oral conditions early enough to preserve satisfactory oral health. The outcome of this type of care is measured in terms of a low dental emergency rate. Maintaining dental care is required if troops are to be sustained beyond a 90-day operation.

COMPREHENSIVE CARE is a level of care which restores an individual to optimal health, function, and esthetics. Although comprehensive care may be achieved incidental to maintaining, sustaining, maxillofacial, and emergency care in individuals whose oral condition is healthy enough to be addressed by the levels of care provided, it is not a level planned for a theater of operations. This level of care is not provided in a theater in order to exercise economy of force.

#### 1.4 METHODOLOGY

##### 1.4.1 Overview

A literature review was conducted. To confirm the historical information, a prospective study on the incidence of dental emergencies on a large military field exercise was carried out. In order to present the data from both the literature and from the field dental emergency study in a form which can be used for simulation, a dental data base was constructed, and the concept of a dental model was developed.

##### 1.4.2 Procedures

###### 1.4.2.1 Literature Review

Information on dental requirements and dental care in a theater was collected from books and journals as well as from unpublished reports and personal communications. The literature was secured from the Library, University of Texas Health Science Center at San Antonio; Medical Library, Brooke Army Medical Center, Fort Sam Houston, Texas; Stimson Library, Academy of Health Sciences, US Army, Fort Sam Houston, Texas; US Army Center for Military History, Washington, DC; and US Army Institute of Dental Research, Washington, DC. The literature review is presented in Chapter 2.

###### 1.4.2.2 Prospective Study

One of a series of NATO military exercises which took place in western Europe in September, October, and November 1982 was selected to examine certain characteristics of dental support to military operations. The series of exercises, named Autumn Forge, involved about 300,000 troops from 14 of NATO's 16 member nations in 24 land, sea, and air exercises. The dental study was conducted during field training exercise Carbine Fortress, which involved 73,000 troops of which 50,000 were US forces. A complete report on the prospective study is contained in Chapter 3 of this paper.

###### 1.4.2.3 Dental Data Base

A list of dental conditions which might be expected to present in a theater of operations was constructed. The list, along with definitions of each condition, was submitted to 18 dental officers for their review and comment. The dental officers included 11 dental consultants to the Army Surgeon General. Based on their input, the list and definitions were revised. The result was a list of 32 dental conditions.

Reports on dental services in a real theater and during field exercises were used to form a composite of incidence rates for several different types of field dental units. Using these dental conditions and incidence rates, an example of task analysis and resource model was fabricated around the treatment of one condition. This example was intended to demonstrate the concept of a dental work load simulation model. Chapter 4 describes The Dental Data Base and proposed model.

#### REFERENCES

1. Operations Analysis Office, Academy of Health Sciences, US Army. Simulation as a tool for military medical combat development and contingency planning. Fort Sam Houston, TX: The Academy, 1981: AHS Label 14.
2. Department of The Army. Field Manual 8-26, Dental Service. Washington, DC: The Department, 1980.

## CHAPTER 2

### LITERATURE REVIEW

The literature on dental care in a theater of operations is primarily anecdotal, and only a few articles provide the kind of quantitative data needed to support simulations. This review will present only those sources which present quantitative data. It will organize the presentation around the way work load is viewed by the authors, i.e., emergency, maintaining/sustaining, and maxillofacial work loads. The definitions of these terms are in Chapter 1.

#### 2.1 DENTAL EMERGENCY WORK LOAD

By far the best reference on dental emergencies in a theater of operations came from US Navy researchers on Navy-Marine personnel serving in Vietnam.<sup>1</sup> Although the title indicated that Navy personnel were in the population, 97% of the studied population were Marines. The similarity of Marine personnel and operations in Vietnam to those of Army personnel and operations makes their results appropriate to this Army study. The Marine study collected data on the characteristics of dental emergencies and treatment both in Vietnam and in two Marine training centers in the United States during the years 1969 and 1970. The size of the populations served in Vietnam varied from 67,500 to 25,500 during the period and from 24,000 to 26,000 at non-Vietnam locations. The non-Vietnam populations were referred to as the "control" for the groups studied in Vietnam. Table 2-1 and Table 2-2 were constructed from tables in the Marine study by multiplying the monthly rates by 12 months to arrive at annual rates per thousand troops. Besides the findings in the tables, it was reported that six percent of the patients in Vietnam used air transportation for all or part of their travel to a treatment site. It was pointed out that approximately one-half of the emergencies were caries related. It should also be observed that the rate in stateside troops was higher than those in the theater of operations.

Although the study itself was never reported, two other articles made reference to results of a data collection effort on dental emergencies in Vietnam by The US Army.<sup>2, 3</sup> The unpublished data were located in storage at the US Army Institute of Dental Research, Walter Reed Army Medical Center, Washington, DC. Although a description of the methodology could not be located, it appears that a special data collection form was used by dental officers throughout Vietnam starting August 1968. The forms were returned to the researchers in the US, where data were input and analyzed monthly by computer. Dr. James B. Cassidy, the author of one of the published articles which made reference to the research, was apparently one of the original investigators. He reported that the initial emergency rate during the study was 143 per thousand troops supported per year and that he suspected this was an underestimate, since he felt that many emergencies did not get reported. Another significant statistic reported was that each soldier was lost to his unit from three to five days when he sought treatment for one of these emergencies. The result of documenting such a large detractor from combat effectiveness was the establishment of a treatment program, the Dental Combat Effectiveness Program (DCEP). Both of the references which quoted the research indicated that the emergency rate was reduced by half, to 73 per thousand per year as a result of the implementation of the DCEP.

Several studies of field exercises have been reported. One covered a four-month desert exercise in 1964.<sup>4</sup> Although the study reported 1,453 dental visits, for an average daily troop strength of 25,714 over a 19-week period, it also reported considerable fluctuation in the troop strength during that period. It was not clear if the same troops were involved for the entire length of time or if there was a turnover in the units which were participating. This would influence the interpretation of the results. This number of visits would reflect an annual rate of 152 per thousand troops. Only 1,205 of these visits were confirmed emergencies, giving a rate of 128 per thousand troops per year. Table 2-3 from this article shows that 47% of the conditions presenting were related to caries. Although the information presented in Table 2-4 on rank distribution is important, the article did not report the distribution of the population supported. Even so, the observation by the author that a large number of high ranking officers and NCOs with dental problems could be critical to the leadership in a theater is valid. Table 2-4 also presents evidence that transportation of dental patients is a significant planning element.

Statistics from two separate field exercises in 1978 were combined to determine the incidence, causal factors, and amount of lost duty time experienced by US Army personnel on field exercises.<sup>5</sup> An annual incidence rate for dental emergencies of 167 per thousand troops was reported. The 438 dental patients who reported for sick call represented 21.5 percent of the total medical/dental sick call. The rate of duty days lost was estimated to be 121.5 per thousand troops supported per year. Table 2-5, Table 2-6, Table 2-7, and Table 2-8 present diagnoses, treatment, and rank distribution of the emergencies.

A study of three separate units which rotated through the National Training Center at Fort Irwin, California combined the data from the separate exercises.<sup>6</sup> The rate of dental emergencies was 223 per thousand per year. Table 2-9, Table 2-10, Table 2-11, and Table 2-12 display the major descriptive findings of the study. It is interesting to note that the most important inferential finding was that participation in the Army's Oral Health Maintenance Program, an annual examination recall, significantly reduced the rate of dental emergencies in the field.

The longest exercise studied was a six month deployment of troops to the Sinai Peninsula, Egypt, as part of the Multinational Force and Observers.<sup>7</sup> During the predeployment period an intensive program of examination and treatment was carried out on the 602 soldiers who were to deploy. The emergency rate for these well-prepared troops was 160 per thousand per year. Table 2-13 and Table 2-14 present the diagnoses and treatment for the Sinai study.

## 2.2 MAXILLOFACIAL WORK LOAD

The difficulty in finding quantitative data on maxillofacial injuries in the theater is that most data were collected by medical epidemiologists using injuries to the "head" or to the "head and neck" as the unit for reporting. Dental planners need to know what proportion of the head and neck injuries were to the face as well as the types of these injuries to the face. Although many good references were found which discussed the surgical management of these wounds, only a few dealt with the epidemiology. The shortcoming in the articles

which do have quantitative data on maxillofacial injuries is that none have data on the number and types of troops supported, making the establishment of rates impossible.

Unanalyzed data were identified at the US Army Patient Administration Systems and Biostatistics Activity located at Fort Sam Houston, TX. Data on hospital admissions in Vietnam, classified by the International Classification of Diseases, Adapted (ICDA), have troop-strength supported information and would be considerably more sensitive to maxillofacial work load analysis than any of the published articles reviewed. Unfortunately, the magnitude of the clean-up and analysis of this data makes it a complete project in itself.

One comprehensive study of maxillofacial injuries in Vietnam was conducted by Army oral surgeons.<sup>8</sup> Survey forms were completed on admissions to the hospital for maxillofacial conditions at selected hospitals. The rates for maxillofacial injuries were expressed as a percent of all trauma admissions. Ten percent of the patients admitted for trauma were for maxillofacial injuries. One hospital reported as high as 23.8 percent of the trauma was maxillofacial. Injured as the result of hostile action (IRHA) represented 68.4 percent of all individuals reported to have sustained maxillofacial injuries. The cause of the injury was reported to be missile fragments in 73.6 percent, bullets in 14.8 percent, and other missiles in 7.6 percent of the IRHA. Facial bone fractures occurred in 39.2 of the IRHA percent. Single and concomitant fractures occurred at the rate of 1.9 bones fractured per fracture patient. Table 2-15 indicates the distribution of fractures among facial bones of IRHA. Tables 2-16A and 2-16B show the distribution of soft tissue types of injuries, and Table 2-17 presents information on patient distribution.

An article from the Korean conflict presented data on a thousand osseous fractures.<sup>9</sup> It reported that 662 (66.2%) of the fractures were to the mandible, 220 (22.2%) were to the maxilla, and 118 (11.8%) were to the zygoma and zygomatic arch, some being a combination of fractures in the same patient. Of the fractures 679 (67.9%) were due to missile wounds, 113 (11.3%) to vehicular accidents, 98 (9.8%) to fights, 44 (4.4%) to blunt instrument blows, 38 (3.8%) to trips and falls, 13 (1.3%) to organized athletics, 11 (1.1%) to blasts and explosions without missile penetration, 2 (0.2%) to pathologic lesions, and 2 (0.2%) to dental extraction. It was estimated that 70 percent of all fractures were combat wounds. Table 2-18 presents data on fractures of the mandible not caused by missiles.

A US Navy article reported a description of hostile-action injured patients treated aboard naval hospital ships in Vietnam for a period of time from March 1966 through February 1967.<sup>10</sup> Hostile-action injured patients represented 79 percent of the maxillofacial patients treated. In this group, 70% had associated fractures of one or more facial bones. Fractures were associated with 61 (70%) of the injured patients. Of the fractures: 11 (18.0%) were mandibular fractures, 34 (55.7%) were midface complex fractures, 11 (18.0%) combination mandibular-midface complex fractures, and 5 (5.7%) were mandibular or maxillary alveolar fractures, or both. In addition, 4.6% of the patients had injuries requiring surgical exposure of one or both carotid arteries. Seventeen

percent required tracheotomy, and 85% were placed under general anesthesia for their surgical care. Penetrating missiles accounted for 80% of the hostile action injuries. Of the penetrating wounds, 38% were caused by bullets. The rest of the penetrating wounds were caused by mortars, mines, booby traps, and miscellaneous explosive devices. Of the 87 patients, 41% were returned directly to active duty in Vietnam under a 60-day evacuation policy for the ship. Of the 59% who were evacuated to the continental US, only two required further major reconstructive procedures.

The four US military services under the Department of Defense have adopted a set of automated medical casualty simulation models for planning.<sup>11</sup> The data base which is used for the gaming is founded on review of available data from several wars. There are named medical conditions which, when used in the simulations, predict requirements for oral surgery assets. Although there is reason to challenge the validity of the numbers used and the way that resources are assigned in the models it is of value to include the incidence figures in this literature review. A further discussion of the quad-service medical casualty simulation models can be found in Chapter 4. Table 2-19 presents data from the model on six named medical patient classes (medical conditions) which relate to maxillofacial injury. It is noted that although the descriptions of patient classes 19 and 20 sound like a portion of oral surgery work load, the simulation never assigns an oral surgeon. The data were provided to The Dental Studies Division at the request of the US Army Assistant Surgeon General for Dental Services by personal communication from The Organizational Analysis Office, Directorate of Combat Development, Academy of Health Sciences, US Army. When the probability of occurrence of all the medical conditions is applied against planning guidance from the Department of the Army, the quad-service models indicate that the six conditions will represent about 1.5% of the total medical work load.

### 2.3 MAINTAINING AND SUSTAINING WORK LOAD

Emergency and maxillofacial work loads are the absolute bottom level of care which must be available to conduct warfare. In order to support operations in a manner which minimizes the inefficient loss of mission time by troops they must have an intermediate level of care which keeps the overall oral health at an adequate level. Sustaining and maintaining care provides this intermediate level. See Chapter 1 for the definitions.

The documentation of these two levels of dental services is difficult. Whereas the incidence of dental emergencies and maxillofacial conditions demand certain levels of services for survival, decisions must be made as to just how much service is adequate to maintain low emergency rates and sustain oral fitness. The level of service provided in past wars may not predict levels consistent with future concepts of operations.

A summary of information from Vietnam in Table 2-20 does not distinguish between those procedures which were emergency/maxillofacial and those which were more routine (that is, sustaining and maintaining). The author of the unpublished book from which the table was extracted also commented that there is evidence that many of the feeder reports did not reach the headquarters and the

data are probably incomplete.<sup>12</sup> Since no information was available from this source as to the number of troops supported no rates could be established. However, using the assumption that the number of troops supported was the same as US Army personnel in Vietnam, rough estimates of the rate of dental treatment can be derived. Using another report<sup>13</sup> as the source of population data in Vietnam, the rate for FY 1969 and FY 1970 would be 2.6 visits per troop supported per year. In FY 1971 the rate was 2.2 dental visits per troop supported per year.

Since no detailed quantitative reports are available to describe the maintaining and sustaining services which have been provided in previous wars it was proposed that this level might resemble that provided by a US Army Dental Activity (DENTAC). This is of course not true since planners for the theater would be looking for austerity in the deployed dental care system. But it is valuable to see what the rate of treatment utilization is in our DENTAC as the point of departure for educating our guess. Table 2-21 displays the number and rate of utilization for each of the Department of Defense defined dental procedures used in Health Services Command (HSC) in FY 82. The rates are expressed as the number per thousand troops supported per year for all military personnel treated. It is interesting to note that by comparison to the 2.6 and 2.2 visits per individual in Vietnam (noted in the previous paragraph), the patients treated per thousand in HSC was 3244.6 or 3.2 visits per individual.

#### REFERENCES

1. Ludwick WE, Gendron EG, Pogas JA, Weldon AL. Dental emergencies occurring among Navy-Marine personnel serving in Vietnam. *Milit Med* 1974 Feb;139:121-3.
2. Neel, S. *Vietnam Studies - Medical support of the US Army in Vietnam*. US Army, 1965-1970. Washington DC: Dept of the Army, 1973.
3. Cassidy JE. Why preventive dentistry? The problem is elephants. *J Am Soc Prev Dent* 1970 Oct;1:6-9,16,30.
4. Sumnicht RW. Report of studies related to the Army Preventive Dentistry Program. *Symposium - Applied preventive dentistry*. Columbia, MO: University of Missouri, 1964:pp. 18-33.
5. Payne TF, Posey WR. Analysis of dental casualties in prolonged field training exercises. *Milit Med* 1981 Apr;146:265-71.
6. Parker WA, King JE, Brunner DG. Assessment of the relationship between past dental experience and dental sick call in the field. *Dental Studies Office Report #81-013*. Fort Sam Houston TX: Academy of Health Sciences, 1981.
7. Teweles R, King JE. Impact of troop dental health on combat readiness. Submitted for publication March 1984.
8. Tinder LE, Osbon DB, Lilly GE, Salem JE, Cutcher JL. Maxillofacial injuries sustained in the Vietnam conflict. *Milit Med* 1969 Sep;134:668-672.

9. Cripps JE, Canham RG, Makel HP. Intermediate treatment of maxillofacial injuries. US Armed Forces Medical Journal, 1953 Jul;4:951-76.
10. Terry BC. Facial injuries in military combat: definitive care. J of Oral Surg, 1969 Jul;27:551-56.
11. Organizational Analysis Office, Academy of Health Sciences, US Army. Simulation as a tool for military medical combat development and contingency planning. Fort Sam Houston, TX: 9 March 1981, AHS Label 14.
12. McConnell RJ. History of the dental services in the Southeast Asian War. Unpublished manuscript, 1974.
13. Heiser JM. Vietnam studies: Logistic support. Washington DC: Dept of the Army; 1974:14.

TABLE 2-1

ANNUAL RATES OF DENTAL EMERGENCIES PER 1000 NAVY-MARINE PERSONNEL  
IN VIETNAM AND NON-VIETNAM LOCATIONS, 1969-1970\*

MONTH	1969 VIETNAM	1970 VIETNAM	1970 NON-VIETNAM
Jul		159.6	235.2
Aug	255.6	136.8	160.8
Sep	187.2	117.6	183.6
Oct	216.0	193.2	360.0
Nov		201.6	244.8
Dec		148.8	244.8
Average	210.0	157.2	240.0
1969/70 Vietnam Average		183.6	

\*Modified from Ludwick, et al.

TABLE 2-2

ANNUAL RATES PER 1000 NAVY-MARINE PERSONNEL FOR DIAGNOSTIC CATEGORIES OF DENTAL EMERGENCIES IN VIETNAM AND NON-VIETNAM LOCATIONS, 1969-1970\*

DIAGNOSTIC CATEGORIES	1969 VIETNAM	1970 VIETNAM	1970 NON-VIETNAM
Caries Related	106.8	76.8	110.4
Periodontal Related	19.2	14.4	26.4
Traumatic Injury	14.4	12.0	14.4
Pericoronitis	33.6	28.8	33.6
Post-Operative Complications	7.2	6.0	9.6
Post-Surgery Complications	6.0	7.2	14.4
Endodontic Complications	9.6	7.2	10.8
Prosthetic Complications	13.2	4.8	20.4
TOTAL	210.0	157.2	240.0

\*Modified from Ludwick, et al.

TABLE 2-3

ARMY DENTAL SERVICE EXPERIENCE, EXERCISE DESERT STRIKE  
15 FEB - 29 JUNE 1964, CONDITIONS SEEN, BY CATEGORY\*

Abscess, periapical	204
Other caries related	480
Periodontal	271
Prosthodontic	144
Pericoronitis	102
Tooth fracture	46
Jaw fracture	20
Other	185
<b>TOTAL</b>	<b>1452</b>

\*Modified from Sumnicht RW.

TABLE 2-4

ARMY DENTAL SERVICE EXPERIENCE, EXERCISE  
DESERT STRIKE, 15 FEB - 29 JUN 1964\*

Patient Ranks (1453)		Patient Travel Data	
Through E-4	994	Less than one mile	345
E-5 through E-9	349	One mile or more ea. way	1108
W.O. and LT.	59	Fifty miles or more	148
CAPT. and MAJ.	43	One hundred mi. or more	46
LT. COL. and COL.	6	Total miles (1108 pts)	47714
Maj. General	2	Avg. per pt. (1108 pts)	43

\*From Sumnicht RW.

TABLE 2-5  
PRIMARY DIAGNOSES FROM 360 EMERGENCY  
DENTAL PATIENTS OVER 39 DAYS\*

DIAGNOSES	N	%	Number/1000 Troops Supported
Caries	139	38.6	5.67
Pericoronitis	58	16.1	2.37
Periapical abscess	37	10.3	1.50
Postoperative problem	35	9.7	1.43
Gingivitis	21	5.8	0.86
Fractured tooth	18	5.0	0.73
Broken prosthesis	13	3.6	0.53
Defective restoration	12	3.3	0.49
Sinusitis	8	2.2	0.33
Soft tissue trauma	7	1.9	0.29
Herpes simplex	3	0.8	0.12
Sialadenitis	3	0.8	0.12
Pain undetermined origin	2	0.5	0.08
Candidiasis	1	0.2	0.04
Aphthous ulcer	1	0.2	0.04
Swelling undetermined origin	1	0.2	0.04
Fractured jaw	1	0.2	0.04
<b>TOTAL</b>	<b>360</b>		<b>14.68</b>

\*Modified from Payne TF and Posey WR.

TABLE 2-6

TREATMENTS RECEIVED BY 360 SOLDIERS REPRESENTING  
438 PATIENT VISITS OVER 39 DAYS\*

TREATMENT	N	%	Number/1000 Troops
Temporary restorations	157	33.1	6.41
Extractions	97	20.4	3.96
Gingival procedures	80	16.8	3.27
Postoperative treatments	67	14.1	2.73
Endodontic procedures	43	9.1	1.76
Permanent restorations	18	3.8	0.73
Prosthesis repairs	13	2.7	0.53
TOTAL	475		19.39

\*Modified from Payne TF and Posey WR.

TABLE 2-7

MEDICATIONS RECEIVED BY 360 SOLDIERS\*

	N	%
Analgesics	210	78.9
Antibiotics	47	17.7
Antihistamines	6	2.3
Antifungal	1	0.3
Anti-inflammatory	2	0.8
TOTAL	266	

\*Modified from Payne TF and Posey WR.

TABLE 2-8  
DISTRIBUTION BY RANK OF 351 DENTAL  
EMERGENCY PATIENTS\*

RANK	N	%
E-1	27	7.7
E-2	50	14.2
E-3	50	14.2
E-4	106	30.2
E-5	54	15.4
E-6	27	7.7
E-7	11	3.1
E-8	2	0.5
E-9	1	0.3
<b>Subtotal</b>	<b>328</b>	<b>93.4</b>
0-1	6	1.7
0-2	3	0.8
0-3	8	2.2
0-4	4	1.1
0-5	2	0.5
<b>Subtotal</b>	<b>23</b>	<b>6</b>
<b>TOTAL</b>	<b>351</b>	<b>100.0</b>

\*Modified from Payne TF and Posey WR.

TABLE 2-9

FREQUENCY OF SICK CALL VISITS, BY THE CONDITIONS WHICH CAUSED THE VISITS IN TRAINING EXERCISES AT FORT IRWIN, CA 1981\*

CONDITION	N	%
Caries	75	41.2
Third molars/pericoronitis	29	15.9
Defective filling/fractured tooth	20	11.0
Gingival/periodontal problems	17	9.3
Trauma	5	2.7
Defective/broken denture/bridge	1	0.5
Non specific/post operative	35	19.2
TOTAL	182	

\*From Parker WA, King JE, and Brunner DG.

TABLE 2-10

FREQUENCY OF TREATMENT RENDERED FOR CONDITIONS WHICH PRESENTED ON DENTAL  
SICK CALL, IN TRAINING EXERCISES AT FORT IRWIN, CA 1981.<sup>t</sup>

TYPE TREATMENT RENDERED	AS PRIMARY TREATMENT*		OF ALL TREATMENT**	
	N	%	N	%
Extraction	38	20.9	39	15.2
Temporary Restoration	33	18.1	41	15.9
Prescription	28	15.4	91	35.4
Endodontic	21	11.5	21	8.2
Gingival/periodontal	13	7.1	13	5.0
Permanent Restoration	10	5.5	13	5.0
Postoperative treatment	9	4.9	9	3.5
Denture/bridge repair	2	1.1	2	0.8
Other treatment	11	6.0	11	4.3
No treatment	17	9.3	17	6.6
TOTAL	182		257	

\*Primary treatment indicates that treatment which was the most definitive treatment rendered for the condition presenting at that appointment.

\*\*All treatment indicates treatment which was rendered as the primary treatment plus other treatment which was rendered secondarily, e.g., prescription secondary to an extraction.

<sup>t</sup>From Parker WA, King JE, and Brunner DG.

TABLE 2-11

DISPOSITION OF DENTAL SICK CALL PATIENTS AFTER TREATMENT  
IN TRAINING EXERCISES AT FORT IRWIN, CA 1981\*

PATIENT DISPOSITION	N	%
Returned to Duty	126	69.2
Returned to Duty/with appointment to be seen in the field	27	14.8
Evacuate to DENTAC	22	12.1
Evacuate to Hospital	2	1.1
Evacuate from Fort Irwin	1	0.5
Unknown	4	2.2
TOTAL	182	

\*From Parker WA, King JE, and Brunner DG.

TABLE 2-12

RANK AND SEX DISTRIBUTION OF SICK CALL GROUP AND CONTROL GROUP IN  
DENTAL RECORD AUDIT, US ARMY P.D./FIELD SICK CALL STUDY, 1981\*

FIELD SICK CALL GROUP		CONTROL GROUP (RANDOM SAMPLE OF NON-SICK CALL)		
	N	% OF SAMPLE	N	% OF SAMPLE
<b>BY RANK:</b>				
E1 - E3	48	52.2	52	53.6
E4 - E5	24	26.1	32	33.0
E6 - E7	10	10.9	5	5.2
E8 - E9	0	0.0	1	1.0
WO1 - WO4	0	0.0	0	0.0
O1 - O2	4	4.3	2	2.1
O3 - O4	2	2.2	3	3.1
O5 - O6	0	0.0	1	1.0
Unknown	4	4.3	1	1.0
<b>BY SEX:</b>				
Male	86	93.5	91	93.8
Female	6	6.5	6	6.2

\*From Parker WA, King JE, and Brunner DG.

TABLE 2-13

INCIDENCE OF DENTAL EMERGENCIES, BY PRESENTING DIAGNOSES  
AMONG US SOLDIERS IN THE SINAI, 1982\*

DIAGNOSES	INCIDENCE	PERCENT OF EMERGENCIES
Caries	8	20.5
Pericoronitis	8	20.5
Periapical abscess	5	12.7
Fractured tooth	4	10.2
Defective restoration	3	7.7
Endodontic complication	3	7.7
Periodontal abscess	3	7.7
Traumatic ulcer	1	2.6
Sialadenitis	1	2.6
Occlusal trauma	1	2.6
Soft tissue laceration	1	2.6
Suture removal	1	2.6
TOTAL	39	

\*From Teweles R, and King JE.

TABLE 2-14

FREQUENCY OF TREATMENT RENDERED FOR DENTAL EMERGENCIES  
AMONG US SOLDIERS IN THE SINAI, 1982\*

TYPE OF TREATMENT RENDERED	PRIMARY TREATMENT		ALL TREATMENT	
	N	%	N	%
Amalgam/resin restoration	5	12.8	5	7.5
Temporary restoration	3	7.7	5	7.5
Extraction	14	35.9	14	20.9
Pulp treatment	8	20.5	8	11.9
Periodontal treatment	4	10.2	12	17.9
Prescription	3	7.7	21	31.3
Suture	1	2.6	1	1.5
Post operative treatment	1	2.6	1	1.5
<b>TOTAL</b>	<b>39</b>		<b>67</b>	

\*From Teweles R, and King JE.

TABLE 2-15

## TYPES OF FACIAL BONES FRACTURED IN 1,096 PATIENTS IRHA\*

Bones Fractured	Number of Patients	Percent of All Patients with Maxillofacial Injuries IRHA
Mandible	573	20.5
Maxilla	526	18.8
Malar	350	12.5
Orbital Floor	238	8.5
Nasal	236	8.4
Zygomatic Arch	219	7.8

\*From Tinder, LE, et al.

TABLE 2-16A  
SITE OF SOFT TISSUE INJURY AS A PERCENT OF INJURY TYPE\*

Site	Type Injury (%)			Total
	Lacerations	Avulsions	Other	
Right cheek	62.7	18.0	19.3	1380
Left cheek	65.0	16.2	18.8	1324
Chin	60.8	12.6	26.6	1054
Lips	68.5	15.2	16.3	816
Floor of mouth	78.1	17.9	4.1	319
Tongue	90.5	6.5	3.0	232
Palate	68.5	26.6	4.9	203
Other fac. tis.	64.8	17.6	17.6	1537
<b>TOTAL</b>				<b>6865</b>

TABLE 2-16B  
TYPE OF SOFT TISSUE INJURY AS A PERCENT OF INJURY SITE\*

Site	Type Injury (%)			Total
	Lacerations	Avulsions	Other	
Right cheek	19.1	22.3	21.6	
Left cheek	19.0	19.2	20.3	
Chin	14.2	11.9	22.8	
Lips	12.4	11.1	10.8	
Floor of mouth	5.5	5.1	1.1	
Tongue	4.6	1.3	0.6	
Palate	3.1	4.8	0.8	
Other fac. tis.	22.0	24.2	22.1	
<b>TOTAL N</b>	<b>4520</b>	<b>1116</b>	<b>1229</b>	<b>6865</b>

\*Modified from Tinder LE, et al.

TABLE 2-17

DISPOSITION OF 2,795 IRHA PATIENTS WITH  
MAXILLOFACIAL INJURIES\*

Disposition	Percent of 157 Outpatients	Percent of 2,638 Inpatients	Percent of Total Maxillofacial
Returned to duty	89.8	25.2	28.8
Died	0.6	2.7	2.5
Transferred or evacuated	6.4	67.9	64.5
Released to own care	1.3	2.5	2.5
Other Disposition	1.9	1.7	1.7

\*From Tinder LE, et al.

TABLE 2-18

## SITE OF 237 MANDIBULAR FRACTURES NOT CAUSED BY MISSILES\*

Involvement	Location	N	Percent of Total
Single area	Condyle	34	14.37
	Ramus	4	1.68
	Angle	63	26.58
	Body	31	13.08
	Symphysis	25	10.54
<b>Subtotal</b>		<b>157</b>	<b>66.25</b>
Double area	Condyle, bilaterally	3	1.27
	Condyle and ramus	1	0.42
	Condyle and angle	6	2.53
	Condyle and body	12	5.06
	Condyle and symphysis	6	2.53
	Ramus and body	4	1.69
	Angles, bilaterally	6	2.53
	Angle and body	25	10.55
	Angle and symphysis	8	3.37
	Body, bilaterally	3	1.27
<b>Subtotal</b>		<b>75</b>	<b>31.64</b>
<b>Multiple areas</b>		<b>5</b>	<b>2.11</b>

\*From Chipps JE, Canham RG, and Makel HP.

TABLE 2-19

## RATES OF MAXILLOFACIAL INJURIES IN A TYPICAL THEATER\*

Pt Class	Description	Frequency /1000 /day	Frequency /1000 /year
15	Fracture, facial bones, closed (exclusive of the mandible) severe-multiple fractures	0.0045882	1.67
16	Fracture, facial bones, closed (exclusive of the mandible) moderate-single fracture	0.0069180	2.53
17	Wound, face, jaws, and neck open, lacerated w/associated fractures, moderate-without airway obstruction	0.1390213	50.74
18	Wound, face, jaws, and neck open, lacerated w/associated fractures, moderate-without airway obstruction	0.1390158	50.74
19	Wound, face and neck, open lacerated, contused without fractures, severe airway obstruction and/or major vessel involvement	0.0109151	3.98
20	Wound, face and neck, open lacerated, contused without fractures, moderate-without airway obstruction or major vessel involvement	0.0254648	9.29
	Daily Maxillofacial rate	0.3259232	
	Annual Maxillofacial rate		118.95

\*From Quad-service medical simulation models.

TABLE 2-20

## US ARMY DENTAL PATIENT VISITS IN VIETNAM, 1968-1973\*

	FY68**	FY69 (14 KJs)	FY70	FY71	FY72 (4 KJs)	FY73**
Restorative	167,057	273,045	249,249	156,259	54,431	8,715
Fixed Prosth.	3,869	9,710	12,064	8,139	4,110	1,054
Remov. Prosth.	31,193	55,928	39,342	26,957	8,786	1,453
Oral Surgery	113,348	174,935	145,868	96,632	31,637	4,583
Periodontics	13,206	16,766	13,653	5,569	1,563	619
Endodontics	8,221	13,501	12,321	8,815	4,287	704
Oral Hygiene (prophylaxis)	64,243	112,332	119,548	83,697	33,808	8,648
Oral Diagnosis (examinations)	192,763	281,673	278,213	179,472	56,235	13,355
Total dental patients treated	593,952	944,974	870,321	565,554	195,365	39,131
Vietnamese extractions (civic actions)	44,470	59,474	NR	NR	NR	NR

\* From McConnell P.J.

\*\* Time period was last three quarters only for FY 1968, and first three quarters only for FY 1973.

TABLE 2-21

## DISTRIBUTION AND RATE OF DENTAL PROCEDURE UTILIZATION IN HEALTH SERVICES COMMAND FY82 (580,375 TROOPS SUPPORTED)

DENTAL PROCEDURES	Number of Unweighted proced (milit)	Rate of Unweighted proced/ 1000 trps	Number of Weighted proced (milit)	Rate of Weighted proced/ 1000 trps
120 ORAL EXAM ANNUAL	621029	1070.0	496823.2	856.0
130 OTHER EXAM	617081	1063.2	246832.4	425.3
133 SCREENING EXAM	304037	523.9	121614.8	209.5
140 COMPREHENSIVE EXAM	85775	147.8	308790.0	532.1
141 POST MORTEM EXAM	134	0.2	830.8	1.4
150 DENTAL CONSULTATION	74189	127.8	51932.3	89.5
160 BLOOD PRESSURE REC	57037	98.3	11407.4	19.7
210 INTRAORAL SERIES	18476	31.8	25866.4	44.6
220 INTRAORAL FILM	1147258	1976.8	229451.6	395.3
250 EXTRAORAL FILM	9418	16.2	4740.5	8.2
310 SIALOGRAPHY	355	0.6	674.5	1.2
330 PANORAMIC FILM	361780	623.4	144712.0	249.3
340 CEPHALOMETRIC FILM	1370	2.4	548.0	0.9
410 BACTERIAL CULTURE	705	1.2	211.5	0.4
420 CAVITIES SUSCEPT TEST	7	0.0	5.6	0.0
450 MACRO TISSUE EXAM	5378	9.3	3226.8	5.6
451 MICRO TISSUE EXAM	3063	5.3	5513.4	9.5
460 ENDO DX TEST	31198	53.8	24958.4	43.0
471 DX CLINICAL PHOTOGRAPHY	9718	16.7	4859.0	8.4
472 IDENT PHOTOGRAPHY	845	1.5	253.5	0.4
1110 ADULT PROPHY	295425	509.0	531765.0	916.2
1120 CHILD PROPHY	0	0.0	0.0	0.0
1240 TOPICAL APPLICATION	239275	412.3	167492.5	288.6
1245 FLUORIDE SELF APPL	37315	64.3	33583.5	57.9
1310 DIETARY PLANNING	6651	11.5	9311.4	16.0
1330 INDIV OHC	978553	1686.1	293565.9	505.8
1331 GROUP OHC	8514	14.7	16176.6	27.9
1350 PIT AND FISSURE	896	1.5	537.6	0.9
1360 PLAQUE AND TISSUE INDICES	225645	388.8	90258.0	155.5
2140 AMALGAM 1 SURFACE	330363	569.2	330363.0	569.2
2150 AMALGAM 2 SURFACE	215037	370.5	408570.3	703.0
2160 AMALGAM 3 SURFACE	97541	168.1	214590.2	369.7
2161 AMALGAM 4 SURFACE	53797	92.7	139872.2	241.0
2210 SILICATE	45	0.1	54.0	0.1
2320 RESIN SIMPLE	79735	137.4	95682.0	164.9
2336 RESIN COMPLEX	72290	124.6	137351.0	236.7
2340 ACID ETCH	107479	185.2	21495.8	37.0
2341 GLAZING	65851	113.5	13170.2	22.7
2342 SEALANT OPERATIVE	16684	28.7	10010.4	17.3

TABLE 2-21 (CONTINUED)

DENTAL PROCEDURES	Number of Unweighted proced (milit)	Rate of Unweighted proced/ 1000 trps	Number of Weighted proced (milit)	Rate of Weighted proced/ 1000 trps
2410 GOLD FOIL I	17	0.0	47.6	0.1
2420 GOLD FOIL II	11	0.0	64.9	0.1
2430 GOLD FOIL III	1	0.0	5.9	0.0
2440 GOLD FOIL IV	5	0.0	40.5	0.1
2450 GOLD FOIL V	35	0.1	217.0	0.4
2460 GOLD FOIL VI	2	0.0	6.8	0.0
2511 INLAY 1 SURFACE	6	0.0	29.4	0.1
2521 INLAY 2 SURFACE	29	0.0	191.4	0.3
2531 INLAY 3 SURFACE	23	0.0	161.0	0.3
2541 ONLAY	59	0.1	460.2	0.8
2542 PINLEDGE	7	0.0	44.8	0.1
2610 PORCELAIN INLAY	12	0.0	58.8	0.1
2910 RECEMENT INLAY/CROWN	12050	20.8	16870.0	29.1
2940 TEMPORARY REST	130031	224.0	65015.5	112.0
2950 CROWN SUBSTRUCTURE	6120	10.5	15300.0	26.4
2952 RESTORATION POLISH	248530	428.2	198824.0	342.6
2953 PIN RETENTION	53195	91.7	21278.0	36.7
2954 INTERMEDIATE BASE	720735	1241.8	144147.0	248.4
2960 RUBBER DAM	245349	422.7	98139.6	169.1
2970 ENAMELOPLASTY/ODONTOPL	24995	43.1	4999.0	8.6
3110 DIRECT PULP CAP	9498	16.4	9498.0	16.4
3120 INDIRECT PULP CAP	32429	55.9	29186.1	50.3
3210 PULPOTOMY DECID	365	0.6	547.5	0.9
3220 PULPOTOMY PERM	14835	25.6	22404.0	38.6
3230 PULPECTOMY TOTAL	32966	56.8	52745.6	90.9
3231 PULPECTOMY PARTIAL	4109	7.1	2876.3	4.0
3311 ANTERIOR 1 CANAL	10563	18.2	24294.9	41.9
3312 ANTERIOR 2 CANALS	173	0.3	432.5	0.7
3321 PREMOLAR 1 CANAL	2322	4.0	6269.4	10.8
3322 PREMOLAR 2 CANALS	2613	4.5	8361.6	14.4
3323 PREMOLAR 3 CANALS	172	0.3	516.0	0.9
3331 MOLAR 1 CANAL	495	0.9	1534.5	2.6
3332 MOLAR 2 CANALS	809	1.4	2993.3	5.2
3333 MOLAR 3 CANALS	7133	12.3	27818.7	47.9
3334 MOLAR 4 CANALS	1729	3.0	7607.6	13.1
3340 DECIDUOUS RCF	18	0.0	43.2	0.1
3350 APEXIFICATION	301	0.5	752.5	1.3
3360 ENDO INTERIM TX	40943	70.5	73697.4	126.0
3410 APICOECTOMY	872	1.5	2877.6	4.0
3420 RETROGRADE FILLING	499	0.9	449.1	0.8
3470 SURGICAL FENESTRATION	140	0.2	140.0	0.2
3480 PNEUMATIZATION	8	0.0	12.8	0.0
3960 BLEACHING	2298	4.0	4366.2	7.5
3970 PERFORATION REPAIR	169	0.3	304.2	0.5

TABLE 2-21 (CONTINUED)

DENTAL PROCEDURES	Number of Unweighted proced (milit)	Rate of Unweighted proced/ 1000 trps	Number of Weighted proced (milit)	Rate of Weighted proced/ 1000 trps
3980 ENDO ENDOSSEOUS IMP	14	0.0	107.8	0.2
3981 ENDO INTERNAL SPLINT	35	0.1	98.0	0.2
4210 GINGIVECTOMY	9981	17.2	14971.5	25.8
4220 GINGIVAL CURETTAGE	20053	34.6	26068.9	44.9
4230 DISTAL WEDGE	7284	12.6	5098.8	8.8
4240 GINGIVAL FLAP	2631	4.5	5262.0	9.1
4250 MUCOGINGIVAL FLAP	31452	54.2	81775.2	140.9
4260 OSSEOUS SURGERY	6555	11.3	9177.0	15.8
4261 OSSEOUS GRAFT	493	0.8	838.1	1.4
4270 PEDICLE GRAFT	368	0.6	883.2	1.5
4271 FREE GRAFT	849	1.5	2037.6	3.5
4272 VESTIBULOPLASTY	569	1.0	1763.9	3.0
4320 PROV SPLINT INTRA	504	0.9	1461.6	2.5
4321 PROV SPLINT EXTRA	552	1.0	1656.0	2.9
4330 OCCLUSAL ADJ LIMITED	96977	167.1	67883.9	115.0
4331 OCCLUSAL ADJ COMP	7899	13.6	56872.8	97.0
4342 PERIO SCALE	1370540	2361.5	822324.0	1416.9
4343 PERIO SCALE AND R.P.	165298	284.8	231417.2	398.7
4351 ROOT DESENSITIZATION	4262	7.3	2983.4	5.1
4361 OCC ORTHOPEDIC APP	628	1.1	1758.4	3.0
4363 OTHER PERIO APP	1202	2.1	1322.2	2.3
4370 HEMISECTION	45	0.1	54.0	0.1
4371 ROOT AMPUTATION	189	0.3	340.2	0.6
4372 BICUSPIDIZATION	6	0.0	9.6	0.0
5110 MAXILLARY COMP	1593	2.7	16407.9	28.3
5120 MANDIBULAR COMP	700	1.2	7210.0	12.4
5130 IMMEDIATE MAX DTR	492	0.8	5608.8	9.7
5140 IMMEDIATE MAND DTR	65	0.1	741.0	1.3
5150 COMP DTR METAL BASES	5	0.0	9.5	0.0
5160 COMP DTR CAST OCCLUS	6	0.0	91.2	0.2
5170 COMP DTR AMALGAM OCCLUS	8	0.0	94.4	0.2
5201 RESIN MAXILLARY	2912	5.0	9318.4	16.1
5202 RESIN MANDIBULAR	727	1.3	2323.4	4.0
5203 CAST METAL MAXILLARY	497	0.9	6113.1	10.5
5204 CAST METAL MAND	628	1.1	7724.4	13.3
5205 CAST MET MAX RES	2176	3.7	26764.8	46.1
5206 CAST MET MAND RES	2624	4.5	32275.2	55.6
5207 PRECISION ATTACHMENT	18	0.0	127.8	0.2
5208 MAX PRECIS ATTACH	7	0.0	280.7	0.5
5209 MAND PRECIS ATTACH	2	0.0	80.2	0.1
5210 CAST MET OCCLUSALS	13	0.0	195.0	0.3
5220 AMALGAM OCCLUSALS	3	0.0	35.7	0.1
5330 CORRECTED CAST RPD	353	0.6	917.8	1.6

TABLE 2-21 (CONTINUED)

DENTAL PROCEDURES	Number of Unweighted proced (milit)	Rate of Unweighted proced/ 1000 trps	Number of Weighted proced (milit)	Rate of Weighted proced/ 1000 trps
5611 REPAIR COMP DTR	1443	2.5	1443.0	2.5
5621 REPAIR RPD	3652	6.3	3652.0	6.3
5699 PRECIS ATTACH RPD	16	0.0	94.4	0.2
5711 MAX DUP DTR	35	0.1	66.5	0.1
5712 MAND DUP DTR	35	0.1	66.5	0.1
5731 RELINE COMP MAX CH	1671	2.9	4344.6	7.5
5732 RELINE COMP MAND CH	469	0.8	1219.4	2.1
5741 RELINE PTR MAX CH	642	1.1	1669.2	2.9
5742 RELINE PTR MAND CH	239	0.4	621.4	1.1
5751 RELINE MAX DTR LAB	430	0.7	1806.0	3.1
5752 RELINE MAND DTR LAB	154	0.3	646.8	1.1
5761 RELINE PTR MAX LAB	32	0.1	60.8	0.1
5762 RELINE PTR MAND LAB	43	0.1	81.7	0.1
5763 REBASE MAX DTR LAB	88	0.2	492.8	0.9
5764 REBASE MAND DTR LAB	21	0.0	117.6	0.2
5765 REBASE PTR MAX LAB	8	0.0	33.6	0.1
5766 REBASE PTR MAND LAB	6	0.0	25.2	0.0
5810 DTR TEMP MAX	2654	4.6	7696.6	13.3
5811 DTR TEMP MAND	900	1.6	2610.0	4.5
5812 DUPE MAX OVERDTR	4	0.0	7.2	0.0
5813 DUPE MAND OVERDTR	1	0.0	1.8	0.0
5814 OVERDTR IMMED MAX	30	0.1	408.0	0.7
5815 OVERDTR IMMED MAND	19	0.0	258.4	0.5
5816 OVERDTR MAX METAL	4	0.0	55.6	0.1
5817 C/ERDTR MAND METAL	1	0.0	13.9	0.0
5825 OVERDTR ATTACHMENT	1	0.0	4.7	0.0
5862 OVERDTR MAX	19	0.0	330.6	0.6
5863 OVERDTR MAND	17	0.0	295.8	0.5
5864 OVERDTR PTR MAX	9	0.0	159.3	0.3
5865 OVERDTR PTR MAND	8	0.0	141.6	0.2
5866 OVERDTR IMM MAX PTR	8	0.0	140.0	0.2
5867 OVERDTR IMM MAND PTR	3	0.0	52.5	0.1
5905 PROS CAST	7	0.0	30.8	0.1
5910 EARS PROS	5	0.0	92.5	0.2
5915 NOSE PROS	0	0.0	0.0	0.0
5920 EYE PROS	4	0.0	74.0	0.1
5925 OTHER PROSTHESIS	2	0.0	37.0	0.1
5930 FACE MASK CUSTOM	24	0.0	444.0	0.8
5935 FACIAL PROSTHESIS	0	0.0	0.0	0.0
5940 IMPLANTS	1	0.0	16.8	0.0
5950 INCLINE PLANE	3	0.0	58.2	0.1
5955 MAND GUIDE PLANE	0	0.0	0.0	0.0
5960 PALATAL LIFT	1	0.0	12.4	0.0

TABLE 2-21 (CONTINUED)

DENTAL PROCEDURES	Number of Unweighted proced (milit)	Rate of Unweighted proced/ 1000 trps	Number of Weighted proced (milit)	Rate of Weighted proced/ 1000 trps
5970 OBTURATOR	4	0.0	86.4	0.1
5980 SPEECH BULB	0	0.0	0.0	0.0
6110 RET ACRYL VENEER	64	0.1	345.6	0.6
6120 RET PORCELAIN	24	0.0	163.2	0.3
6130 RET PFM	9302	16.0	63253.6	108.0
6140 RET REVERSE PIN	77	0.1	369.6	0.6
6150 RET PART VENEER MET	1170	2.0	6669.0	11.5
6160 RET COMP METAL	2995	5.2	16173.0	27.9
6170 INTRACORONAL RETAINERS	3	0.0	3.0	0.0
6201 PONTIC COMP METAL	7649	13.2	10708.6	18.5
6203 PONTIC PORCELAIN	78	0.1	93.6	0.2
6204 PONTIC ACR VENEER	125	0.2	150.0	0.3
6205 REVERSE PIN FACING	4	0.0	4.8	0.0
6220 PONTIC SLOT FACING	28	0.0	53.2	0.1
6240 PONTIC PFM	8826	15.2	13239.0	22.8
6610 REPLACE FACING	817	1.4	2942.5	5.1
6611 STAIN AND GLAZE	14302	24.6	30034.2	51.7
6612 BROKEN CONNECTOR	1003	1.7	4112.3	7.1
6710 CR ACRYL PROCESSED	1910	3.3	7258.0	12.5
6711 CR ACRYL PREFAB	10476	18.1	21999.6	37.9
6712 CR ACRYL AUTOPOLY	23257	40.1	48839.7	84.1
6713 CR ACRYL VENEER	137	0.2	1109.7	1.9
6718 DOWEL AND CORE	6502	11.2	28608.8	49.3
6719 CR STAINLESS INTER	10914	18.8	22919.4	39.5
6720 CR STAINLESS PRMNT	0	0.0	0.0	0.0
6740 CR PORCELAIN	163	0.3	1809.3	3.1
6750 CR PFM	13134	22.6	145787.4	251.2
6760 CR REV PIN FACING	50	0.1	530.0	0.9
6780 CR PTR VENEER MET	706	1.2	5577.4	9.6
6790 CR COMP MET	7547	13.0	57357.2	98.8
7110 TOOTH REMOVAL	88445	152.4	61911.5	106.7
7120 TOOTH REM COMP	39342	67.8	47210.4	81.3
7130 TOOTH REM IMP	66948	115.4	93727.2	161.5
7140 TRANSPLANT/REPLANT	405	0.7	1296.0	2.2
7150 SURGICAL EXPOSURE	352	0.6	950.4	1.6
7210 WOUND SIMP <5 CM	952	1.6	1142.4	2.0
7211 WOUND SIMP >5 CM	179	0.3	322.2	0.6
7212 WOUND COMPLEX <5 CM	266	0.5	691.6	1.2
7213 WOUND COMPLEX >5 CM	246	0.4	1303.8	2.2

TABLE 2-21 (CONTINUED)

DENTAL PROCEDURES	Number of Unweighted proced (milit)	Rate of Unweighted proced/ 1000 trps	Number of Weighted proced (milit)	Rate of Weighted proced/ 1000 trps
7260 CLEFT PALATE REPAIR	1	0.0	10.6	0.0
7265 CLEFT LIP REPAIR	2	0.0	14.4	0.0
7270 O-A FISTULA REPAIR	85	0.1	161.5	0.3
7275 O-N FISTULA REPAIR	11	0.0	58.3	0.1
7280 SKIN OR MUCOSAL GR	33	0.1	79.2	0.1
7285 BONE GRAPH/OSSEOUS IMPL	71	0.1	1249.6	2.2
7310 ALVEOLOPLASTY W EXT	37992	65.5	30393.6	52.4
7320 ALVEOLOPLASTY	3788	6.5	4545.6	7.8
7340 STOMATOPLASTY UNCOMP	504	0.9	907.2	1.6
7350 STOMATOPLASTY COMP	222	0.4	1176.6	2.0
7405 SAL GLAND SURG	288	0.5	1411.2	2.4
7412 EXCISION SOFT TISSUE	21639	37.3	23802.9	41.0
7432 EXCISION BENIGN	348	0.6	835.2	1.4
7442 EXCISION MALIG TUMOR	36	0.1	190.8	0.3
7452 REM ODONT. TUMOR	21753	37.5	54382.5	93.7
7462 REM NON-ODONT TUMOR	1584	2.7	1900.8	3.3
7465 DEST OF LESIONS	67	0.1	80.4	0.1
7470 REM EXOSTOSIS	900	1.6	1530.0	2.6
7480 PTR RESECTION MAX/MAND	20	0.0	70.0	0.1
7481 SEQUESTRESTOMY	1063	1.8	1381.9	2.4
7485 RADICAL RESECTION	2	0.0	17.6	0.0
7511 INCISION AND DRAINAGE	5670	9.8	6237.0	10.7
7520 BIOPSY	7033	12.1	9846.2	17.0
7530 REM FOREIGN BODY	302	0.5	453.0	0.8
7560 MAX SINUSOTOMY	127	0.2	355.6	0.6
7570 CRICOHYROTOMY	1	0.0	0.3	0.0
7580 TRACHEOSTOMY	4	0.0	10.8	0.0
7610 MAXILLA OPEN RED	48	0.1	248.6	0.4
7620 MAXILLA CLOSED RED	215	0.4	774.0	1.3
7630 MAND OPEN RED	269	0.5	1398.8	2.4
7640 MAND CLOSED RED	463	0.8	1666.8	2.9
7651 ZMC FRACTURE	81	0.1	380.7	0.7
7680 FACIAL BONE FRACTURE	60	0.1	336.0	0.6
7681 OTHER FX RED	73	0.1	350.4	0.6
7685 INTERMAX FIXATION	1435	2.5	5166.0	8.9
7690 MAXILLOFACIAL APP	1621	2.8	5025.1	8.7
7711 MAX OSTEOTOMY TOTAL	115	0.2	1219.0	2.1
7712 MAX OSTEOTOMY SEGMENTAL	215	0.4	1526.5	2.6
7721 MAND OSTEOTOMY RAMUS	328	0.6	2886.4	5.0
7722 MAND OSTEOTOMY BODY	110	0.2	781.0	1.3
7755 AUGMENT CONTOUR REDUCTION	61	0.1	323.3	0.6
7811 REDUCTION OF DISLOCATION	121	0.2	108.9	0.2
7815 MYOFASCIAL PAIN DYS TX	1851	3.2	3516.9	6.1
7835 MAND MANIPULATION	1489	2.6	1191.2	2.1
7845 TMJ SURGERY	84	0.1	739.2	1.3

TABLE 2-21 (CONTINUED)

DENTAL PROCEDURES	Number of Unweighted proced (milit)	Rate of Unweighted proced/ 1000 trps	Number of Weighted proced (milit)	Rate of Weighted proced/ 1000 trps
7880 ARTHROGRAPHY	48	0.1	86.4	0.1
7901 POST SURGICAL TX	105450	181.7	52725.0	90.8
7902 OSTEITIS TX	10399	17.9	5199.5	9.0
7960 FRENECTOMY	650	1.1	845.0	1.5
8110 SPACE MAINT REM	26	0.0	31.2	0.1
8120 SPACE MAINT SIMPLE	19	0.0	28.5	0.0
8121 SPACE MAINT COMPLEX	133	0.2	239.4	0.4
8210 HABIT BREAKER REM	27	0.0	239.4	0.4
8212 HABIT MOUTH BREATH	8	0.0	7.2	0.0
8220 HABIT BREAKER FIXED	7	0.0	10.5	0.0
8310 SIMPLE HAWLEY	382	0.7	343.8	0.6
8311 COMPLEX HAWLEY	477	0.8	572.4	1.0
8320 REM EXP APPL SIMPLE	17	0.0	17.0	0.0
8322 FIXED EXP APPLIANCE	27	0.0	43.2	0.1
8330 BITE PLANE ANTERIOR	41	0.1	49.2	0.1
8331 BITE PLANE POSTERIOR	22	0.0	26.4	0.0
8410 BANDING	1012	1.7	910.8	1.6
8420 BONDING	3645	6.3	1822.5	3.1
8440 SECTIONAL WIRE	436	0.8	261.6	0.5
8441 IDEAL ROUND ARCHWIRE	464	0.8	417.6	0.7
8442 ROUND COMPLEX WIRE	261	0.4	391.5	0.7
8443 RECT IDEAL ARCHWIRE	214	0.4	256.8	0.4
8444 RECT COMPLEX WIRE	299	0.5	538.2	0.9
8445 PASSIVE LING WIRE	30	0.1	36.0	0.1
8446 FACE BOW HOOKS CUP	13	0.0	15.6	0.0
8447 ACTIVE LING WIRE	35	0.1	42.0	0.1
8448 MULTI-STRAND WIRE	440	0.8	264.0	0.5
8510 ARCHWIRE ADJUST	2731	4.7	1638.6	2.8
8511 REMBL APP ADJ	2205	3.8	1102.5	1.9
8512 HEADGEAR ADJ	106	0.2	53.0	0.1
8513 LIGATION ADJ	4506	7.8	1351.8	2.3
8520 ADD AUXILLARIES	2442	4.2	732.6	1.3
8530 BAND REMOVAL	1061	1.8	318.3	0.5
8531 BOND ATTACH REM	1764	3.0	529.2	0.9
8532 FIXED LING ARCH REM	149	0.3	89.4	0.2
8540 POSITIONER INS	20	0.0	22.0	0.0
8552 APPLIANCE REPAIR	112	0.2	123.2	0.2
8553 CRANIOFAC ANALYSIS	1644	2.8	2466.0	4.2
8997 FULL BANDED START	0	0.0	0.0	0.0
8998 FULL BANDED FIN	0	0.0	0.0	0.0
8999 PARTIAL TX	0	0.0	0.0	0.0
9210 LOCAL ANES DX	21820	37.6	13092.0	22.6
9211 LOCAL ANES TPY	791563	1363.9	316625.2	545.6
9212 DIVISION BLOCK	4793	8.3	2875.8	5.0

TABLE 2-21 (CONTINUED)

DENTAL PROCEDURES	Number of Unweighted proced (milit)	Rate of Unweighted proced/ 1000 trps	Number of Weighted proced (milit)	Rate of Weighted proced/ 1000 trps
9220 GENERAL ANESTHESIA	1342	2.3	2147.2	3.7
9231 I.V. SED	5271	9.1	6325.2	10.9
9232 I.M. SED	193	0.3	115.8	0.2
9233 INHAL SED ANALGESIA	4085	7.0	3268.0	5.6
9234 ORAL SED	994	107	298.2	0.5
9235 HYPNOSIS	58	0.1	52.2	0.1
9610 THERAP MED INJECT	3455	6.0	1727.5	3.0
9630 OTHER THERAP MED	143599	247.4	86159.4	148.5
9631 PRESCRIPTIONS	192919	322.4	57875.7	99.7
9710 HOSP WARD ROUNDS	46141	79.5	13842.3	23.9
9715 GRAND ROUNDS	7354	12.7	4412.4	7.6
9720 HOSP ADMISSIONS	4068	7.0	2150.4	37.1
9901 AFTER HOURS TX	0	0.0	0.0	0.0
9918 POST OP TX	78491	135.2	39245.5	67.6
9922 SURG PCDR FOR DX	528	0.9	950.4	1.6
9923 DENTAL CAST	114441	197.2	91552.8	157.7
9924 DX MOUNTING	2231	3.8	9147.1	15.8
9925 MAND RECORDING	143	0.2	1387.1	2.4
9926 LAB ADJUNCTIVE MED	4152	7.2	2906.4	5.0
9927 CELLULITIS TX	2651	4.6	2120.8	3.7
9940 MOUTH PROTECTORS	2375	4.1	2137.5	3.7
9941 RESIN STINTS	563	1.0	3321.7	5.7
9942 FLUORIDE CARRIERS	103	0.2	92.7	0.2
9943 RADIATION SHIELD	0	0.0	0.0	0.0
9944 RAD NEEDLE CARRIERS	0	0.0	0.0	0.0
9971 HYPERBAR MONITORING	1	0.0	10.6	0.0
9972 PNT HANDLING TIME DX	912566	1572.4	730052.8	1257.9
9973 PNT HANDLING TIME TX	1188732	2048.2	1307605.2	2253.0
9999 PNTS TREATED	1883061	3244.6		
TOTAL PROCEDURES	13647249		10186039.2	

## Chapter 3

### DENTAL EMERGENCIES DURING A MILITARY FIELD EXERCISE

#### 3.1 INTRODUCTION

A knowledge of the dental work load which can be anticipated in an area of military operations is important in medical readiness planning. Unfortunately, the vigorous requirements of providing care during previous conflicts have interfered with our record keeping, and planners today are left with insufficient data on which to base resource decisions. The purpose of this chapter is to provide data which will assist analysts in estimating the dental work load in an area of operations. Chapter 3 is a report of a study of dental emergencies during a military field exercise, Exercise Carbine Fortress, 82.

In an area of military operations dental work load is the work which must be accomplished in order to minimize the interference of dental disease and injury with the accomplishment of the mission. Work can be described in terms of what procedures and tasks must be performed. If appropriate sets of resources can be quantified relative to each procedure or task, a useful planning model can be constructed.

This type of resource modeling has been accomplished for medical work load at the Academy of Health Sciences, US Army. It is constructed around a list of medical conditions which present to medical treatment facilities in a theater. Each medical condition has been submitted to a task analysis in order to identify what procedures will be necessary to treat each condition and what resources will be needed for each procedure. The resources addressed include personnel, time, equipment, supplies, facilities, and evacuation resources. These data, along with the probability of occurrence of each of the conditions, make up a data base which is used for computer simulations of different theater scenarios to predict resource requirements and to test capabilities of certain sets of resources. Unfortunately, the only dental conditions on the medical condition list are maxillofacial injuries. This makes planning for dental operations from this model impossible.

#### 3.1.1 PURPOSE

The purpose of this study is to provide experienced-based information on dental conditions which presented during a military field training exercise. Specifically, it reports descriptive information concerning the rate of occurrence of dental conditions, the treatment procedures which were provided, and the disposition of patients after treatment. The results of the study were useful in the proposal of a dental work load data base model and are similar to the Academy of Health Science medical work load models. See Chapter 4.

#### 3.1.2 BACKGROUND

A series of multi-service and multi-nation military exercises took place in western Europe in the Fall of 1982. The series of exercises, together

named Exercise Autumn Forge, involved approximately 300,000 troops from 14 of NATO's 16 member nations in 24 land, sea, and air exercises. One of the exercises involved the deployment of 19,000 US Army and US Air Force troops from continental United States to Europe (REFORGER Exercise). Another exercise utilized these troops as well as European-based US troops and forces from other nations in a large field exercise (Exercise Carbine Fortress).

Carbine Fortress was selected for data collection for the dental study. This exercise simulated a real war situation in that it displaced large numbers of troops to areas geographically remote from their normal source of dental care. It placed the troops under the physical and psychological stress of extended living and working in the field. It was the exercise policy that the primary source of dental care would be from field dental service deployed with the troops. Previous attempts to study exercises in Europe had been frustrated by the fact that this policy of providing the services in the field had been ignored by line units, and soldiers with dental problems had been sent to the nearest known fixed dental facility. The fixed facilities are numerous and convenient in the exercise areas of Germany. Although it seemed desirable to study the dental work load during the deployment and staging phases of the exercises, the difficulties of coordinating the data collection over a global area with so many alternate sources of care made this effort impractical. The difficulties of securing population information from the US Navy, US Air Force, and forces from other nations made a study of forces other than US Army a major problem.

The field dental services for Carbine Fortress resembled doctrine on the delivery of dental services in that tactical units of brigade size were supported by unit level dental care from clearing stations of medical companies. The similarities between doctrine and practice on Carbine Fortress stops there. Whereas doctrine calls for oral and maxillofacial surgery only at corps level hospitals, the two combat support hospitals in the exercise had dental augmentation to be able to provide unit and area dental support for the treatment of dental emergencies. In addition, all medical and dental facilities in the area of operations were alerted to support walk-in dental emergencies of exercise personnel. No area support dental detachments (i.e., HA detachments) were made operational in the exercise.

Dental assets were provided from US Army 7th Medical Command (7th MEDCOM), US Army Forces Command (FORSCOM), and US Army Health Services Command (HSC).

### 3.2 METHODOLOGY

#### 3.2.1 OVERVIEW

All dental officers assigned to field dental service or fixed facilities in the area of the 1982 Carbine Fortress Exercise recorded data on patient encounter forms. The forms were processed by Dental Studies Division (DSD), US Army Health Care Studies and Clinical Investigation Activity, Fort Sam Houston, Texas. An automated statistical program was used to generate descriptive statistics of the data.

### 3.2.2 PROCEDURES

- a. FORSCOM and 7th MEDCOM provided the name of each dental officer who was to be assigned or attached to a unit providing field dental services to Carbine Fortress. In addition, a map of the area of operations allowed personnel from the Assistant Chief of Staff for Dental Service to identify every dental clinic which might receive exercise patients.
- b. The principal investigator spoke in person or by telephone with each participant or his commander prior to the exercise in order to provide guidance on the conduct of the study. A "REFORGER 82 Dental Work Load Study Instruction Booklet" was distributed along with the "REFORGER 82 Field Dental Encounter Form."
- c. It should be noted that a list of dental conditions was defined for the Carbine Fortress study. The condition list and the definitions which accompany them were revised after the conduct of the Carbine Fortress study for the dental model proposal (See Chapter 4 and Appendix). Although the lists are similar, the two should not be confused.
- d. The instructions also indicated that the dental procedures and codes commonly used by the Department of Defense were to be used. The definitions for the dental procedures were listed in the Standard Operating Procedures for the Dental Service Report System. These definitions are currently published in Army Regulation 40-182.
- e. All forms distributed were given sequence numbers and were accounted for by the unit or person to whom they were sent. At the end of the exercise, all forms whether completed, blank, or voided were returned to DSD as a means of form control.
- f. The study period was limited to the 10 days starting 13 September 1982 and ending 22 September 1982. During that period all encounters with Carbine Fortress troops at field dental facilities and fixed dental clinics in or around the exercise area were recorded on the "REFORGER 82 Field Dental Encounter Form."
- g. Forms were submitted which predated and postdated the official days of Carbine Fortress, and they were processed but not included in the analysis. Encounters with members of other services and other nations were also excluded from the analysis. Only encounters which were indicated as "emergency" or follow-up on emergencies were included in the analysis.
- h. All of the forms were manually edited for accuracy and completeness by DSD. Several questions concerning the accuracy of the forms were resolved by telephone interviews with the submitting dental officer.
- i. Data were key punched and verified to data processing cards by US Army Health Care Systems Support Activity (HCSSA), at Fort Sam Houston, Texas. The data were then transferred to US Army Regional Data Center 1, at Fort Belvoir, VA by magnetic data processing tape. The data was accessed by terminals of the

VIABLE system located at HCSSA at Fort Sam Houston by DSD personnel. A Statistical Analysis System (SAS) program was used to further clean up the data and perform statistical analysis.

### 3.3 FINDINGS

#### 3.3.1 STAFFING AND FACILITIES

Thirteen dental officer positions were staffed during the exercise at 10 field sites. Four dental officers accompanied stateside units which deployed to Europe and 20 dental officers from 7th MEDCOM rotated through nine other field dental officer positions. Thirty dental officers at 11 7th MEDCOM fixed facilities also saw exercise troops for dental emergency care. See Table 3-1.

#### 3.3.2 EMERGENCIES

a. Three hundred fifty-five dental emergency visits over the 10 days of supporting 49,902 U.S. troops<sup>2</sup> were reported. These emergency visits were made by 339 different patients. In addition to the 355 emergency treatment visits, 113 visits were made for treatments which were described as routine in nature. Field sites received 192 (54%) of the emergency visits and 7th MEDCOM fixed facilities received 163 (46%). Complications of previous treatment represented 21 (9.6%) of the visits.

b. The rank distribution of the emergencies indicate that 322 (93%) were in enlisted ranks, 3 (0.9%) were warrant officers, and 18 (5.1%) were officers. See Table 3-2.

c. See Tables 3-3, 3-4, and 3-5 for age, race, and sex distribution of the patients for each patient visit.

d. There was an even distribution of dental emergency visits over the 10 days of the study. See Table 3-6.

e. The problem (dental condition) which caused the emergency visit is the "primary diagnosis." Dental conditions which were diagnosed as being related to the problem but which were not the primary factor which caused the visit were the "additional diagnoses." The frequency of occurrence of visits and the percent of the total number of dental visits for each primary diagnosis, additional diagnosis, and a total of all diagnoses are reported in Table 3-7.

f. Table 3-8 presents the treatment rendered for primary diagnosis; Table 3-9 the treatment for additional diagnosis; and Table 3-10 for all diagnoses. A single condition may be treated with a single treatment procedure or, more often, it receives a primary treatment and several additional treatments. For example, a patient may present with "caries, severe" and receive "tooth removal" as the only treatment; or he may also receive a "prescription" as an additional treatment. Both single treatments and primary treatments are reported in Table 3-8 and Table 3-9 as "Primary Treatments." Further procedures which were rendered as adjuncts to the primary treatment, i.e., "prescription", are reported as "Additional Treatment." Other tasks related to the treatment may

be rendered, such as local anesthesia and record completion, but these tasks were not considered as treatments in and of themselves and are not reported. The reason for not accounting for these tasks is the observation on the part of the authors upon editing the forms that there was an inconsistency among dental officers as to whether these tasks were reported. "All" treatments are the sum of the primary and additional treatment procedures.

g. The disposition of patients after emergency treatment is presented in Table 3-11. No patients were evacuated by air. Of those retained at the field facility, 13 patients had reports of length of retention before returning to duty. One spent 168 hours at a fixed hospital facility as a result of a fractured mandible. Excluding this patient, the average length of retention was 35 hours. The primary diagnoses for patients which required evacuation are indicated in Table 3-12.

### 3.4 DISCUSSION

#### 3.4.1 STUDY CONSTRAINTS

It has been postulated that an important variable which influences the dental emergency rate, treatment, and evacuation is the organizational distribution of facilities in the theater of operations. It was hoped that because there was to be an emphasis during the 1982 Carbine Fortress Exercise on treatment in the field this characteristic could be studied. Unfortunately, 46% of the dental emergencies reported to 7th MEDCOM fixed facilities. Although it can be argued that the fixed facilities could be regarded as a surrogate for dental HA detachments, they were not distributed in such a way in the exercise area as to simulate theater organization. Also, contrary to the doctrinal guidance on theater organization for dental services, general dentistry support was provided at the hospitals. It was, therefore, decided to analyze the data as if they were the total dental emergency work load and to not attempt to study the theater distribution.

Another important question which can not be addressed by this study is what effect the length of deployment will have on dental emergencies. Many troops had been living in the field for several weeks during Carbine Fortress. However, there was no way to quantify this characteristic for analysis.

The rate of occurrence of dental emergencies is the most useful information which can be analyzed for future use. The rate is usually expressed as occurrences per thousand troops at risk per year. The Office of Operations, Plans, and Security at 7th MEDCOM was not able to report the number of Army troops in the operation. They were able to provide the number of US Forces overall. Since the emergencies which could accurately be accounted for were in Army troops participating in the exercise, the use of 49,902 US Forces in the calculations makes the rates reported in this paper underestimates.

#### 3.4.2 EMERGENCIES

The rate of dental emergencies on Exercise Carbine Fortress was 259 per thousand troops per year. This rate of dental emergencies will negatively affect the combat effectiveness of any unit. If dental emergencies are to be

treated in the area of operations it will take soldiers away from the conduct of their mission in large numbers for significant periods of time. However, the soldier can usually be treated with relatively simple procedures and returned directly to duty. If emergencies are not treated, more serious sequelae will create casualties which must be hospitalized, a potentially even more serious effect on lost mission time. Even if dental disease is tolerable by the troop it will be physically debilitating and will adversely effect his fitness to fight and his morale.

The obvious operational implication of this for troop commanders is for them to take action before deployment to reduce the potential of dental emergencies during combat. That is, make oral fitness a part of the "fit to fight" concept. To medical planners this discussion should mean placing appropriate dental assets in a location, when organizing medical care, which will allow for rapid return to duty of dentally sick and injured soldiers. It also means providing a deployable dental care system to assist troop commanders in sustaining the oral fitness of their troops in a theater of operations. Another obvious comment to be made is that dental readiness programs should be developed for troop commanders by DENTAC to help reduce the emergency rate of deployable units.

Very little significance can be attached to the rank, age, race, and sex distributions of emergency patients since the rank, age, race, and sex distribution of the troops on the exercise are unknown. That is, the fact that 80% of the emergencies occurred in ranks E-5 and below may seem significant, but it may very well be that 80% of the troops on the exercise were of rank E-5 or below. These demographic data are presented in the paper only to describe the population who reported for dental emergencies.

What are the dental illnesses and injuries which present to dental facilities during deployment? Approximately 48% of the problems were related to caries. Prosthodontic problems represent approximately seven percent. Gingival/periodontal problems were involved in 9.5%. Oral and facial trauma represent about seven percent, and 15 percent involved third molar pericoronitis. The remainder of the visits were for a variety of other conditions. It should be pointed out that these were emergency dental visits and do not include severe maxillofacial trauma, which is admitted to hospitals, nor sustaining dental care, which might also be treated in the theater.

It is apparent from the foregoing paragraph that dental readiness programs need to address the treatment and prevention of emergencies related to caries and third molars. Together they represent 63% of the problems which presented at this exercise.

When considering the dental emergency work load which must be addressed in resource planning, it is probably best to look at the "All" treatment columns of Table 3-8, Table 3-9, and Table 3-10. The work load reported in these tables is not complete unless the adjunctive tasks which were required to complete the treatments are considered. Not included in the listing are tasks such as radiography, examinations, anesthesia, rubber dam, bases under restorations, etc. As was noted in item 6 of the "Findings" these were not reported because

of inconsistent reporting; however, it was assumed that reasonable estimates of these tasks could be made if the number of patients and patient visits were considered along with the types of treatment procedures.

A commonly held belief is that treatment rendered in a field environment is different from treatment rendered in a fixed facility. If this is true, the portion of the emergencies which were treated at fixed facilities on this exercise would have biased the profile of treatment away from the treatment profile which might be expected in a totally field environment. Table 3-13 displays the frequency and percent distribution of each of the procedures rendered in both field and fixed facilities. In addition, the procedures were grouped to show the percent of procedures in the restorative, endodontic, periodontic, prosthodontic, and extraction types of procedures. An examination of Table 3-13 would tend to support the idea that more extractions are done in the field than in fixed facilities and that more restorations are done at fixed facilities than in the field.

The interesting effect of seeing patients in the field environment is that which is observed in Table 3-14. The diagnoses in Table 3-14 are grouped into those which, by definition, would have predicted treatment with restorative, endodontic, prosthodontic, periodontic, or extraction procedures. This table seems to indicate that there is a difference in the diagnoses which are derived by examinations in the field. Either patients with the need to have extractions are more likely to report to field facilities, or the field environment must have an influence on the diagnostic perception of the dental officers. This difference in diagnoses between the two treating environments would in part explain the difference in treatments.

If almost 40% of the diagnoses were those which would have predicted extraction, as it did for the field facility in Table 3-14, you would expect to see about 40% of the procedures in the extraction procedure group in Table 3-13. Instead, about half that percentage was seen. This divergence is also observed in the fixed facility, although not quite as markedly. The authors conjecture that the prevailing attitude among dental officers toward treatment of patients under the conditions of an exercise is to use temporary or interim types of procedures instead of more definitive ones. It is also noted that "sedative, temporary restoration" accounted for a large proportion of the restorative procedures, and prescription was a large percentage of all procedures.

Pharmacy support was important to the treatment of these patients considering that one-fourth of the visits required a prescription. In six percent of the visits prescription was the primary treatment. The types and quantities of drugs prescribed were not addressed in this study.

Army doctrine apparently does not address the transportation of dental patients. Discussions with medical planners indicate that there is an assumption that dental facilities are co-located with medical facilities and that normal evacuation channels will be used. It is also assumed that the requirement for transportation will be so small that it is insignificant for planning purposes and can be absorbed into the planning for medical services. As far as the authors could determine, these assumptions were not based on any

objective evidence. This study indicated that a need exists for transportation of Dental Emergency patients at the rate of 260 per thousand troops supported per year. This does not include any transportation requirements for sustaining dental care or for maxillofacial injury. The authors' assumption is that maxillofacial injury which requires hospitalization is addressed as medical requirements for transportation. Sustaining and maintaining dental care, that care which will be provided by HA detachments in order to sustain the oral health of troops during a prolonged operation, has not been documented nor has the requirement for transportation.

Further analysis of this data was used to develop the concept of dental modeling reported in Chapter 4. Some conclusions drawn from the analysis will be reserved for Chapter 5.

#### REFERENCES

1. Department of the Army, AR 40-182, Dental Statistical Reporting, Washington, DC: The Department, 1 Oct 1983.
2. Troops supported reported by O'Haver, DR. Assistant Chief of Staff, Operations, Plans, and Security, US Army 7th MEDCOM, official correspondence, undated.

TABLE 3-1

## FREQUENCY AND DISTRIBUTION OF DENTAL EMERGENCY VISITS AT FIXED AND FIELD DENTAL FACILITIES, EXERCISE CARBINE FORTRESS, 1982

SITE	FREQUENCY	PERCENT
<b>Field Facility</b>		
128TH CSH	53	14.9
2ND CSH	52	14.6
1ST MED BN, SPT CO	15	4.2
1ST MED BN, B CO	24	6.8
1ST MED BN, D CO	5	1.4
3RD MED BN, SPT CO	12	3.4
3RD MED BN, B CO	12	3.4
3RD MED BN, C CO	6	1.7
47TH MED BN, SPT CO	10	2.8
47TH MED BN, B CO	3	0.8
<b>Fixed Facility</b>		
Wharton BKS	10	2.8
Dolan BKS	18	5.1
Stork BKS	14	3.9
McKee BKS	8	2.2
67TH EVAC H	42	11.8
Harvey BKS	8	2.2
Ledward BKS	39	11.0
Beden BKS	13	3.7
Wildflecken	2	0.6
130TH ST H	8	2.3
Fliegerhorst	1	0.3
<b>TOTAL</b>	<b>355</b>	

TABLE 3-2

RANK DISTRIBUTION OF DENTAL EMERGENCY VISITS,  
EXERCISE CARBINE FORTRESS, 1982

RANK	FREQUENCY	PERCENT
<b>Enlisted</b>		
E1	7	2.0
E2	36	10.1
E3	85	23.9
E4	92	25.9
E5	59	16.6
E6	34	9.6
E7	12	3.4
E8	4	1.1
E9	3	0.8
<b>Warrant Officer</b>		
W2	2	0.6
W3	1	0.3
<b>Officer</b>		
O2	6	1.7
O3	10	2.8
O5	2	0.6
<b>Unknown</b>		
	2	0.6

TABLE 3-3

AGE DISTRIBUTION OF DENTAL EMERGENCY PATIENTS,  
EXERCISE CARBINE FORTRESS, 1982

AGE	NUMBER	PERCENT	CUMULATIVE PERCENT
18	4	1.13	1.13
19	23	6.48	7.61
20	49	13.80	21.41
21	41	11.55	32.96
22	45	12.68	45.63
23	26	7.32	52.96
24	23	6.48	59.44
25	19	5.35	64.79
26	14	3.94	68.73
27	21	5.92	74.65
28	15	4.23	78.87
29	3	0.85	79.72
30	7	1.97	81.69
31	2	0.56	82.25
32	10	2.82	85.07
33	3	0.85	85.92
34	6	1.69	87.61
35	4	1.13	88.73
36	4	1.13	89.86
37	2	0.56	90.42
38	8	2.25	92.68
39	2	0.56	93.24
40	3	0.85	94.08
41	1	0.28	94.37
42	2	0.56	94.93
43	3	0.85	95.77
48	1	0.28	96.06
52	2	0.56	96.62
unknown	12	3.38	100.00
TOTAL	355	100.00	

TABLE 3-4

RACE DISTRIBUTION OF DENTAL EMERGENCY PATIENTS,  
EXERCISE CARBINE FORTRESS, 1982

RACE	NUMBER	PERCENT
Caucasian	215	60.56
Black	116	32.68
Hispanic	19	5.35
Other	3	0.85
Unknown	2	0.56
TOTAL	355	100.00

TABLE 3-5

SEX DISTRIBUTION OF DENTAL EMERGENCY PATIENTS,  
EXERCISE CARBINE FORTRESS, 1982

SEX	NUMBER	PERCENT
Male	321	90.42
Female	34	9.58
TOTAL	355	100.00

TABLE 3-6

TIME DISTRIBUTION OF DENTAL EMERGENCY VISITS,  
EXERCISE CARBINE FORTRESS, 1982

EXERCISE DATE	FREQUENCY	PERCENT
13 Sep	50	14.1
14 Sep	34	9.6
15 Sep	37	10.4
16 Sep	48	13.5
17 Sep	44	12.4
18 Sep	20	5.6
19 Sep	28	7.9
20 Sep	51	14.4
21 Sep	20	5.6
22 Sep	23	6.5

TABLE 3-7

PRIMARY, ADDITIONAL, AND ALL DIAGNOSES FOR DENTAL EMERGENCIES  
EXERCISE CARBINE FORTRESS, 1982

DENTAL CONDITION	DIAGNOSES					
	Primary		Additional		All	
	N	%	N	%	N	%
Caries, mild	5	1.41	0	0.00	5	1.31
Caries, moderate	24	6.76	4	15.38	28	7.35
Caries, advanced	63	17.75	8	30.77	71	18.64
Caries, severe	75	21.13	1	3.85	76	19.95
Complication of caries tx	3	0.85	0	0.00	3	0.79
Defective filling	16	4.51	1	3.85	17	4.46
Defective crown	5	1.41	0	0.00	5	1.31
Defective fixed prosth.	11	3.10	1	3.85	12	3.15
Defective removable prosth.	8	2.25	2	7.69	10	2.62
Occlusal/incisal trauma	4	1.13	0	0.00	4	1.05
Accretions on teeth	0	0.00	1	3.85	1	0.26
Gingivitis	9	2.54	0	0.00	9	2.36
Periodontitis, mild	2	0.56	0	0.00	2	0.52
Periodontitis, advanced	4	1.13	1	3.85	5	1.31
Periodontitis, severe	2	0.56	1	3.85	3	0.79
Periodontal, abscess	7	1.97	0	0.00	7	1.84
Recurrent aphthous	0	0.00	1	3.85	1	0.26
ANUG	6	1.69	0	0.00	6	1.57
TMJ disorder	3	0.85	0	0.00	3	0.79
Tooth fracture	13	3.66	2	7.69	15	3.94
Third molar/pericoronitis	51	14.37	3	11.54	54	14.17
Complication of third molar tx	2	0.56	0	0.00	2	0.52
Alveolitis	12	3.38	0	0.00	12	3.15
Oral/facial contusion	1	0.28	0	0.00	1	0.26
Facial wound	1	0.28	0	0.00	1	0.26
Mandibular fracture	2	0.56	0	0.00	2	0.52
Multiple oral/facial injury	8	2.25	0	0.00	8	2.10
Other diagnosed condition	10	2.82	0	0.00	10	2.62
Undiagnosed condition	7	1.97	0	0.00	7	1.84
Condition not reported	1	0.28	0	0.00	1	0.26
<b>TOTAL</b>	<b>355</b>		<b>26</b>		<b>381</b>	

TABLE 3-8  
TREATMENTS RENDERED FOR PRIMARY DIAGNOSES  
EXERCISE CARBINE FORTRESS, 1982

DENTAL TREATMENT	TREATMENTS					
	Primary		Additional		All	
	N	%	N	%	N	%
Amalgam, 1 surface	4	1.13	0	0.00	4	0.73
Amalgam, 2 surface	6	1.69	2	1.05	8	1.47
Amalgam, 3 surface	5	1.41	0	0.00	5	0.92
Amalgam, 4 or more surfaces	2	0.56	0	0.00	2	0.37
Sedative, temporary rest.	54	15.21	30	15.79	84	15.41
Pin retention	0	0.00	1	0.53	1	0.18
Resin, simple	2	0.56	0	0.00	2	0.37
Resin, complex	4	1.13	0	0.00	4	0.73
Glaze composite	0	0.00	1	0.53	1	0.18
Enameloplasty	0	0.00	1	0.53	1	0.18
Recement fixed cr/prosth.	5	1.41	0	0.00	5	0.92
Pulpectomy, permanent	12	3.38	0	0.00	12	2.20
Pulpectomy, total	23	6.48	1	0.53	24	4.40
Pulpectomy, partial	13	3.66	0	0.00	13	2.39
Endo interim treatment	7	1.97	0	0.00	7	1.28
Anterior endo fill	0	0.00	1	0.53	1	0.18
Prophylaxis	5	1.41	3	1.58	8	1.47
Indiv. oral hyg. counseling	3	0.85	10	5.26	13	2.39
Gingivectomy	1	0.28	0	0.00	1	0.18
Gingival curettage	6	1.69	0	0.00	6	1.10
Occlusal adjustment	6	1.69	7	3.68	13	2.39
Periodontal scaling	9	2.54	4	2.11	13	2.39
Perio scaling and root pl.	2	0.56	1	0.53	3	0.55
Osseous resective surgery	0	0.00	1	0.53	1	0.18
Distal wedge	0	0.00	1	0.53	1	0.18
Remov partial dtr (resin)	2	0.56	0	0.00	2	0.37
Complete dtr repair	2	0.56	0	0.00	2	0.37
Partial dtr repair	5	1.41	0	0.00	5	0.92
Acrylic crown	4	1.13	0	0.00	4	0.73
Tooth removal	35	9.86	0	0.00	35	6.42
Tooth removal, complicated	37	10.42	0	0.00	37	6.79
Tooth removal, impacted	22	6.20	0	0.00	22	4.04
Wound repair	3	0.85	1	0.53	4	0.73
Alveoloplasty	1	0.28	1	0.53	2	0.37
Sequestrectomy	1	0.28	0	0.00	1	0.18
Odontogenic cyst removal	0	0.00	1	0.53	1	0.18
Incision and drainage	8	2.25	2	1.05	10	1.83
Maxilla closed reduction	1	0.28	0	0.00	1	0.18
Intermaxillary fixation	1	0.28	0	0.00	1	0.18
Post surgical treatment	6	1.69	2	1.05	8	1.47
Osteitis treatment	6	1.69	0	0.00	6	1.10
Other medication	1	0.28	0	0.00	1	0.18
Prescription	21	5.92	118	62.11	139	25.50
Post operative treatment	6	1.69	1	0.53	7	1.28
No treatment rendered	22	6.20	0	0.00	22	4.04
Not indicated	2	0.56	0	0.00	2	0.37
<b>TOTAL</b>	<b>355</b>		<b>190</b>		<b>545</b>	

TABLE 3-9

TREATMENTS RENDERED FOR ADDITIONAL DIAGNOSES  
EXERCISE CARBINE FORTRESS, 1982

DENTAL TREATMENT	TREATMENTS					
	Primary		Additional		All	
	N	%	N	%	N	%
Glaze composite	1	3.45	0	0.00	1	2.27
Amalgam, 1 surface	0	0.00	1	6.67	1	2.27
Sedative, temporary rest.	2	6.90	6	40.00	8	18.18
Occlusal adjustment	1	3.45	0	0.00	1	2.27
Pulpectomy, total	0	0.00	1	6.67	1	2.27
Prophylaxis	1	3.45	0	0.00	1	2.27
Indiv. oral hyg. counseling	3	10.34	1	6.67	4	9.09
Periodontal scaling	2	6.90	0	0.00	2	4.55
Perio scaling and root pl.	1	3.45	0	0.00	1	2.27
Gingivectomy	0	0.00	1	6.67	1	2.27
Tooth removal	0	0.00	1	6.67	1	2.27
Tooth removal, complicated	0	0.00	2	13.33	2	4.55
Tooth removal, impacted	0	0.00	1	6.67	1	2.27
Post surgical treatment	1	3.45	0	0.00	1	2.27
Prescription	17	58.62	1	6.67	18	40.91
TOTAL	29		15		44	

TABLE 3-10  
TREATMENTS RENDERED FOR ALL DIAGNOSES  
EXERCISE CARBINE FORTRESS, 1982

DENTAL TREATMENT	ALL TREATMENTS	
	N	%
Amalgam, 1 surface	5	0.85
Amalgam, 2 surface	8	1.36
Ama'gam, 3 surface	5	0.85
Amalgam, 4 or more surfaces	2	0.34
Sedative, temporary rest.	92	15.62
Pin retention	1	0.17
Resin, simple	2	0.34
Resin, complex	4	0.68
Glaze composite	2	0.34
Enameloplasty	1	0.17
Re cement fixed cr/prosth.	5	0.85
Pulpectomy, permanent	12	2.04
Pulpectomy, total	25	4.24
Pulpectomy, partial	13	2.21
Endo interim treatment	7	1.19
Anterior endo fill	1	0.17
Prophylaxis	9	1.53
Indiv. oral hyg. counseling	17	2.89
Gingivectomy	2	0.34
Gingival curettage	6	1.02
Occlusal adjustment	14	2.38
Periodontal scaling	15	2.55
Perio scaling and root pl.	4	0.68
Osseous resective surgery	1	0.17
Distal wedge	1	0.17
Remov partial dtr (resin)	2	0.34
Complete dtr repair	2	0.34
Partial dtr repair	5	0.85
Acrylic crown	4	0.68
Tooth removal	36	6.11
Tooth removal, complicated	39	6.62
Tooth removal, impacted	23	3.90
Wound repair	4	0.68
Alveoloplasty	2	0.34
Sequestrectomy	1	0.17
Odontogenic cyst removal	1	0.17
Incision and drainage	10	1.70
Maxilla closed reduction	1	0.17
Intermaxillary fixation	1	0.17
Post surgical treatment	9	1.53
Osteitis treatment	6	1.02
Other medication	1	0.17
Prescription	157	26.66
Post operative treatment	7	1.19
No treatment rendered	22	3.74
Not indicated	2	0.34
<b>TOTAL</b>	<b>589</b>	

TABLE 3-11

DISPOSITION OF SOLDIERS AFTER DENTAL EMERGENCY VISITS  
EXERCISE CARBINE FORTRESS, 1982

DISPOSITION	N	%
Returned to duty (RTD)		
RTD, no follow-up needed for this	130	36.62
RTD, should return to field clinic	45	12.68
RTD, report to clinic after exercise	140	39.44
Retained at field facility before RTD	18	5.07
Evacuated by ground transportation	19	5.35
Not indicated	3	0.85
<b>TOTAL</b>	<b>355</b>	

TABLE 3-12

PRIMARY DIAGNOSES FOR PATIENTS REQUIRING EVACUATION  
EXERCISE CARBINE FORTRESS, 1982

DENTAL CONDITION	N	%
Caries, advanced	1	5.26
Caries, severe	6	31.58
Tooth fracture	1	5.26
Third molar/pericoronitis	4	21.05
Facial wound	1	5.26
Mandibular fracture	1	5.26
Multiple oral/facial injuries	3	15.79
Undiagnosed condition	2	10.53
TOTAL	19	

TABLE 3-13  
COMPARISON OF FIELD AND FIXED FACILITY TREATMENT  
EXERCISE CARBINE FORTRESS, 1982

DENTAL TREATMENT	Field Facility			Fixed Facility		
	N	%	Tx Group	N	%	Tx Group
Amalgam, 1 surface	2	0.66		3	1.18	
Amalgam, 2 surface	1	0.33		7	2.76	
Amalgam, 3 surface	2	0.66		3	1.18	
Amalgam, 4 or more surfaces			Restor 18.03	2	0.79	Restor 27.56
Pin retention				1	0.39	
Resin, simple				2	0.79	
Resin, complex	1	0.33		3	1.18	
Glaze composite				1	0.39	
Enameloplasty	1	0.33				
Recement fixed cr/prosth.	3	0.98		2	0.79	
Sedative, temporary rest.	45	14.75		46	18.11	
Pulpotomy, permanent	5	1.64		7	2.76	
Pulpectomy, total	12	3.93	Endo 8.85	13	5.12	Endo
Pulpectomy, partial	7	2.30		6	2.36	12.20
Anterior endodontic filling	1	0.33				
Endo interim treatment	2	0.66		5	1.97	
Occlusal adjustment	2	0.66		11	4.33	
Prophylaxis	8	2.62				
Indivi. oral hyg. counseling	12	3.93		2	0.79	
Gingivectomy	1	0.33	Perio 12.13	1	0.39	Perio
Gingival currage	5	1.64		1	0.39	9.45
Periodontal scaling	7	2.30		6	2.36	
Perio scaling and root pl.	2	0.66		1	0.39	
Osseous resective surgery				1	0.39	
Distal wedge				1	0.39	
Remov partial dtr (resin)				1	0.79	
Complete dtr repair	1	0.33	Prosth 1.97	1	0.39	Prosth
Partial dtr repair	3	0.98		2	0.79	2.76
Acrylic crown	2	0.66		2	0.79	
Tooth removal	22	7.21	Extract 18.69	14	5.51	Extract
Tooth removal, complicated	23	7.54		16	6.30	16.14
Tooth removal, impacted	12	3.93		11	4.33	
Alveoloplasty	1	0.33		1	0.39	
Sequestrectomy				1	0.39	
Odontogenic cyst removal				1	0.39	
Incision and drainage	4	1.31		6	2.36	
Wound repair	3	0.98		1	0.39	
Maxilla closed reduction	1	0.33				
Intermaxillary fixation				1	0.39	
Post surgical treatment	5	1.64		3	1.18	
Osteitis treatment	1	0.33		5	1.97	
Other medication				1	0.39	
Prescription	88	28.85		52	20.47	
Post operative treatment	2	0.66		5	1.97	
No treatment rendered	18	5.90		4	1.57	
TOTAL	305			254		
Not indicated			30			
OVERALL TOTAL			589			

TABLE 3-14  
COMPARISON OF THE DIAGNOSES AT FIELD AND FIXED FACILITIES  
EXERCISE CARBINE FORTRESS, 1982

DENTAL CONDITION	Field			Fixed		
	Tx Group		%	Tx Group		%
Caries, mild	4	1.96	Restor	1	0.57	Restor
Caries, moderate	9	4.41	8.82	19	10.80	18.18
Defective filling	5	2.45		12	6.82	
Caries, advanced	33	16.18	Endo	38	21.59	Endo
Complication of caries tx	2	0.98	17.16	1	0.57	22.16
Defective crown	4	1.96	Prosth	1	0.57	Prosth
Defective fixed prosth.	5	2.45	7.35	7	3.98	6.82
Defective removable prosth.	6	2.94		4	2.27	
Occlusal/incisal trauma	2	0.98		2	1.14	
Accretions on teeth	1	0.49		0	0.00	
Gingivitis	5	2.45		4	2.27	
Periodontitis, mild	2	0.98	Perio	0	0.00	Perio
Periodontitis, advanced	2	0.98	10.78	3	1.70	10.80
Periodontitis, severe	1	0.49		2	1.14	
Periodontal abscess	3	1.47		4	2.27	
Recurrent aphthous	1	0.49		0	0.00	
ANUG	3	1.47		3	1.70	
TMJ disorder	2	0.98		1	0.57	
Third molar/pericoronitis	34	16.67	Extract	20	11.36	Extract
Caries, severe	47	23.04	39.71	29	16.48	27.84
Compli of third molar tx	0	0.00		2	1.14	
Tooth fracture	6	2.94		9	5.11	
Alveolitis	6	2.94		6	3.41	
Oral/facial contusion	1	0.49		0	0.00	
Facial wound	1	0.49		0	0.00	
Mandibular fracture	1	0.49		1	0.57	
Multiple oral/facial injuries	6	2.94		2	1.14	
Other diagnosed condition	8	3.92		2	1.14	
Undiagnosed condition	4	1.96		3	1.70	
<b>TOTAL</b>		204			176	
<b>OVERALL TOTAL</b>			380.00			

## CHAPTER 4

### DENTAL DATA BASE AND MODEL

Simulation of an operation has become a popular and useful tool for planning in many disciplines. The Department of Defense has accepted simulation for the purposes of planning for future military operations in the form of a computerized data base and modeling programs developed at the Academy of Health Sciences, US Army in San Antonio, Texas.

A review of these medical models and data base has revealed that there are limitations in the area of dental work load. The most obvious problem with the data base is that it does not have conditions which reflect dental or oral disease. The only dental conditions which are reflected in the data base are maxillofacial injuries which have been documented as admissions to hospitals. An inspection of how these conditions are treated in the simulation models indicates that only four of 309 conditions are simulated to be the work of dental personnel (oral surgeons). The models do not identify any enlisted personnel when personnel requirements are modeled. Dental officers who have had experience in the field and in actual theaters of operations report that there are more of the 309 conditions which are part of the dental officer's work load at hospitals. Other than dental sections of hospitals, no other dental organization is simulated, i.e., HA dental service detachments, dental sections of clearing platoons, etc. Although the oral surgeon is defined as the "preferred treater" for a number of maxillofacial operations and is available at hospitals being simulated, the computer programs frequently assign these operations to otorhinolaryngologists. The medical models are also designed to describe an acute casualty/hospital admission/evacuation system. It is not designed to simulate the type of chronic disease/outpatient operation which is typical of most dental service.

This chapter describes the structure of a dental data base and model which would resemble the medical data base and models and would better match the operation of dental services. The purpose of trying to approximate the structure of the medical models is to make the output of dental models compatible with analysis output of non-dental models.

#### 4.1 DENTAL CONDITIONS

The medical models relate all resource planning to the expected frequency of occurrence of 309 medical conditions. In order to structure a dental model similarly, a list of dental conditions was constructed, and rates of occurrence were applied to the size of a population to arrive at the expected frequency. Unlike many of the medical conditions, the rate of occurrence of dental conditions is not related so closely to the scenario or geographic area of the world as it is to the hygiene habits of the population and their access to maintaining dental care. It is assumed, however, that the intensity of combat will increase the rate of maxillofacial injury and decrease access to maintaining dental care.

The dental conditions listed in the International Classification of Diseases (ICD) were reviewed as a possible source of a condition list.<sup>1</sup> The list proved useful in establishing a first attempt and taught the research team that it was difficult to use the terms from the ICD to predict the types of dental resources which might be needed for treatment.

The search for other condition lists revealed that there is no other standard list of dental conditions accepted by a national or international organization. Although the American Dental Association has a standardized, coded list of dental procedures, it does not have such a standard list for diagnoses. The only other references available were from studies reported in the literature. The literature reviewed in Chapter 2 contributed to the establishment of a dental conditions list. Although the purpose of the dental study of Carbine Fortress Exercise 82 reported in Chapter 3 was not to serve as a pilot for the use of the condition list, it did help to refine the definitions as they related to field dental service.

Important to the development of the final list was the use of a Delphi methodology for seeking expert input. That is, the list was mailed to each of the 11 dental consultants to the US Army Surgeon General. These consultants represent board qualified specialists in each specialty of dentistry. In addition to the consultants, seven other dental officers were given copies of the list. All of the experts received written instructions on the purpose of the condition list and were asked to make any additions, deletions, and modifications to the list. The purpose of the list was described as being a transition vocabulary between what could be diagnosed clinically and what could be used in simulation modeling to predict resources. Each of the 18 experts returned written revisions and comments and most offered further discussion by telephone or in person.

#### 4.2 RATES OF OCCURRENCE

Since there are no studies which relate directly to the list, interpretation was needed to convert data from all of the studies reviewed in Chapter 2 and reported in Chapter 3 into incidence rates for the Theater Army Dental Data Base (TADD8). In establishing the mission of a dental organization, Army doctrine states that some dental units will treat only maxillofacial injury, e.g., corps zone hospitals; others will treat only dental emergencies, e.g., clearing platoon dental section. It is assumed that certain types of work load will be diverted to, or away from, certain types of facilities depending on the doctrinal mission. For that reason, it was proposed that different rates of occurrence would be established according to the mission of the unit.

#### 4.3 SIMULATION

The following sample computer screens are offered as the proposal for the structure of a resource simulation using the condition list and incidence rates developed for a unit with the mission of the treatment of dental emergencies (e.g., an Army clearing platoon dental section) in a low intensity combat environment and in support of approximately 4000 troops.

**-PROPOSAL-**  
**THEATER ARMY DENIAL WORK LOAD SIMULATION**

**Dental Studies Division**  
**US Army Health Care Studies and Clinical Investigation Activity**

## A proposal of computer screens for a theater dental simulation.

## Dental Simulation Program

1 April 1984

## **SELECT TYPE OF DENTAL FACILITY BY ITS MISSION.**

## Mission

Type 1 Dental emergency care  
 Type 2 Maxillofacial injuries and oral surgery referral  
 Type 3 Dental emergency and maintaining care

Press [RETURN] to continue.

Dental Simulation Program

1 April 1984

SELECT INTENSITY OF CONFLICT.

- Low battle casualties
- High battle casualties

Press [RETURN] to continue

3

Dental Simulation Program

1 April 1984

ENTER NUMBER OF TROOPS SUPPORTED.

4000

Press [RETURN] to continue.

4

Dental Simulation Program

1 April 1984

Dental Simulation Program is simulating a Type 1 dental facility,  
in an environment of low battle casualties, and  
in support of 4,000 troops.

SELECT THE TYPE OF ANALYSIS DESIRED

- Resource requirement for a single condition.
- Total personnel time requirement for all conditions
- Total equipment, durable and consumable requirement  
for all conditions.

Press [RETURN] to continue.

5

THE INCIDENCE RATE (PER 1000 TROOPS/YR), NUMBER OF PATIENTS WHICH CAN BE EXPECTED AT THE FACILITY PER YEAR (#/FAC/YR), AND THE NUMBER OF PATIENTS WHICH CAN BE EXPECTED PER FACILITY PER DAY (#/FAC/DAY) ARE DISPLAYED BELOW.

TADD CODE	DENTAL CONDITION	INCIDENCE RATES*	\$/FAC/YR	\$/FAC/DAY
1	Caries/mod	24.00	96.00	0.26
2	Caries/adv	45.00	180.00	0.49
3	Caries/seve	50.00	200.00	0.55
4	Def. fillin	12.00	48.00	0.13
5	Def. CastRes	10.00	40.00	0.11
6	Def. RemfrM1	0.50	2.00	0.01
7	Def. RemfrM2	2.00	8.00	0.02
8	Def. RemCry	2.50	10.00	0.03
9	Def. RemLast	1.50	6.00	0.02
10	Uccusal Tr	0.50	2.00	0.01
11	Accretions	0.00	0.00	0.00
12	Gingivitis	0.00	0.00	0.00
13	Perio/early	7.00	28.00	0.08
14	Perio/mild	7.50	30.00	0.04
15	Perio/sever	2.50	10.00	0.03
16	Perio Absce	5.50	22.00	0.06
17	RectU/V Lesi	2.50	10.00	0.03
18	ANUG	4.00	16.00	0.04
19	TMJ Disorde	0.00	0.00	0.00
20	Pericoronit	35.00	132.00	0.36
21	Alveolitis	8.00	32.00	0.09
22	T.Frac. Mode	4.00	16.00	0.04
23	T.Frac. sever	4.00	16.00	0.04
24	Tooth E/V/Su	0.50	2.00	0.01
25	Oral Burn	0.50	2.00	0.01
26	S.T.Tr/mild	10.00	40.00	0.11
27	S.T.Tr/mod	10.00	40.00	0.11
28	Fac Fra/mod	0.00	0.00	0.00
29	Fac Fra/sev	0.00	0.00	0.00
30	Benign L/Ne	0.00	0.00	0.00
31	Malign. L/Ne	0.00	0.00	0.00
32	Orthodontic	0.00	0.00	0.00
33	Other	10.00	40.00	0.11
<b>TOTAL</b>		<b>233.00</b>	<b>1012.00</b>	<b>2.77</b>

- TYPE IN THE TADDB CODE FOR THE DENTAL CONDITION TO BE ANALYZED.
- TADDB CODE? 1
- Press [RETURN] TO CONTINUE.

THE TREATMENTS MOST COMMONLY PROVIDED AT A TYPE I FACILITY FOR CAVIES MODERATE ARE LISTED BELOW. ALSO LISTED ARE TREATMENT ALTERNATIVE CODES (TX ALTER), THE DOD PROCEDURE CODES (PROCEDURE CODES), AND THE PROBABILITY OF EACH OF THE TREATMENTS BEING PROVIDED FOR THIS CONDITION AT THIS TYPE OF FACILITY (PROB. OF TX).

CONDITION	TX	PROCEDURE			PROB.
CONDITION	CODE	ALTER.	PROCEDURE	COIN	OF TX
Caries, no	01		0101	Amalg 1su	0.02
			0102	Amalg 2su	0.20
			0103	Amalg 3su	0.20
			0104	Amalg 4+5	0.03
			0106	Resin sim	0.01
			0107	Resin com	0.01
			0120	Sed/Temp	0.50
			0170	AcrCr Pre	0.01
			0171	AcrCr Aut	0.01
			0173	SS/Al Cro	0.01
					1.00

- TYPE IN THE TREATMENT ALTERNATIVE CODE (TX ALTER) FOR TREATMENT DESIRED FOR ANALYSIS. ( THE DEFAULT IS THE MOST PROBABLE TREATMENT)
- TX ALTER CODE? 0120
- 
- 
- Press (RETURN) TO CONTINUE.

PERSONNEL TIME REQUIREMENTS BASED ON A TREATMENT PROCEDURE AND  
TASK ANALYSIS ARE PRESENTED BELOW FOR A SEDATIVE/TEMPORARY  
RESTORATION ( DOD PROCEDURE CODE 02940) AT A TYPE I FACILITY.  
ALL TIMES ARE IN MINUTES.

PROCEDURE	ADJCT. TASKS	PROCEDURE CODE	OFFICER TYPE	DENTAL			DENTAL ASSISTANT TYPE	DENTAL ASSISTANT TX TIME	DENTAL HYGIENIST TX TIME
				OFFICER TX TIME	ASSISTANT TX TIME	ASSISTANT TX TIME			
Sed/temp		02940	63A/B	15	91E	15		0	
	Oth Exam	00130	63A/B	4	91E	4		0	
	Pt Handls	09973	63A/B	5	91E	10		0	
	Intrader. X	00220		0	91E	5		0	
	L. Anesth.	09211	63A/B	3		0		0	
	Rubber Da	02960	63A/B	3	91E	3		0	
				-----		-----			
				TOTAL TIME	30	37			

Press (RETURN) to continue to equipment, durable,  
and consumable analysis.

EQUIPMENT, DURABLES, AND CONSUMABLES REQUIRED DELIVER A  
SEDATIVE/TEMPORARY RESTORATION AT A TYPE I FACILITY ARE LISTED BELOW.

EQUIPMENT/FACILITY:	QUANT.	NSN
GENERAL DENTISTRY EQUIPMENT SET	ES 1	XXXX-XX-XXX-XXXX
DENTAL X-RAY EQUIPMENT SET	ES 1	XXXX-XX-XXX-XXXX

PROCEDURE

/TASK

02740	BASIC OPERATIVE DENTISTRY TRAY	T	1	
	SPONGE SURGICAL 2X2	C	.01	XXXX-XX-XXX-XXXX
	PELLET ABSORBENT COTTON	C	.001	XXXX-XX-XXX-XXXX
	BUR, #4 ROUND, LATCH	C	.03	XXXX-XX-XXX-XXXX
	BUR, #6 ROUND, LATCH	C	.05	XXXX-XX-XXX-XXXX
	BUR, FG #73 1/3	C	.05	XXXX-XX-XXX-XXXX
	BUR, FG #700L	C	.05	XXXX-XX-XXX-XXXX
	EVACUATION TIP, DISPOSABLE	C	.01	XXXX-XX-XXX-XXXX
	SALIVA EJECTOR TIP, DISPOSABLE	C	.01	XXXX-XX-XXX-XXXX
	WEDGES, WOOD	C	.001	XXXX-XX-XXX-XXXX
	MATRIX BANDS	C	.02	XXXX-XX-XXX-XXXX
	COTTON ROLLS	C	.02	XXXX-XX-XXX-XXXX
	IRM	C	.001	XXXX-XX-XXX-XXXX
00120	EXAMINATION TRAY	T	1	
	SPONGE SURGICAL 2X2	C	.01	XXXX-XX-XXX-XXXX
09973	DAILY TREATMENT LOG FORMS	C	.04	XXXX-XX-XXX-XXXX
	PATIENT DENTAL RECORD FORM 603	C	1	XXXX-XX-XXX-XXXX
	PATIENT NAPKIN	C	1	XXXX-XX-XXX-XXXX
00220	DEVELOPER, X-RAY	C	.01	XXXX-XX-XXX-XXXX
	FIXER, X-RAY	C	.01	XXXX-XX-XXX-XXXX
	FILM, INTRADURAL	C	1.1	XXXX-XX-XXX-XXXX
	ENVELOPE, X-RAY	C	1	XXXX-XX-XXX-XXXX
09211	LIDOCAIN HCL	C	.02	XXXX-XX-XXX-XXXX
	SPONGE SURGICAL 2X2	C	.01	XXXX-XX-XXX-XXXX
02960	RUBBER DAM MATERIAL	C	.01	XXXX-XX-XXX-XXXX
	DENTAL FLOSS	C	.01	XXXX-XX-XXX-XXXX
	PETROLEUM LUBRICANT	C	.01	XXXX-XX-XXX-XXXX

ES = EQUIPMENT SET. THE CONTENTS INCLUDE EQUIPMENT, DURABLES AND CONSUMABLES WHICH ARE NOT USUALLY ASSOCIATED WITH ANY PARTICULAR PROCEDURE, BUT WHICH ARE NEEDED FOR THE PROVISION OF DENTAL CARE. THE QUANTITIES ARE PER FACILITY.

T = TRAY. IT IS MADE UP OF THE DURABLES NEEDED TO CARRY OUT A CATEGORY OF TREATMENT: FOR EXAMPLE, AN OPERATIVE DENTISTRY TRAY WOULD CONSIST OF THOSE INSTRUMENTS NEEDED TO PREPARE TEETH AND PLACE AMALGAM, RESIN, OR TEMPORARY RESTORATIVE MATERIALS. QUANTITIES ARE IN TRAYS PER PATIENT, AND THE CONTENTS ARE REUSABLE.

C = CONSUMABLES. ITEMS OF SUPPLY WHICH ARE USED ONE TIME. THE QUANTITIES ARE PER PATIENT, AND DECIMALS ARE FRACTIONS OF THE NORMAL UNIT OF DISTRIBUTION.

\*\*\*\*\*  
\* Press [RETURN] to return to the main menu.  
\*  
\*\*\*\*\*

The following two computer screens illustrate the effect of a change in the battle intensity on the numbers of patients to be treated in a simulation of a Type 2 facility. The facility simulated here is similar to an Army corps level hospital in support of 20,000 troops.

Low battle casualty environment.

TECHNIC TREATMENT 200,000 x 1000

DENTAL FACILITY, TYPE C MISSION: MAXILLOFACIAL INJURY  
REFERRALS FOR D.S.

EDDIE CODE	DENTAL CONDITION	INCIDENCE RATE*	#/FAC/YR	#/FAC/DAY
1	Caries/mod	0.00	0.00	0.00
2	Caries/adv.	0.00	0.00	0.00
3	Cari. Severe	4.00	80.00	0.22
4	Den. Fract/In	0.00	0.00	0.00
5	Den. Fract/Res	0.00	0.00	0.00
6	Den. RemFr Ma	0.00	0.00	0.00
7	Den. RemFr Mo	0.00	0.00	0.00
8	Den. RemFr	0.00	0.00	0.00
9	Den. RemCast	0.00	0.00	0.00
10	Den Fract/ Tr	0.00	0.00	0.00
11	Accident/one	0.00	0.00	0.00
12	Impacted/teeth	0.00	0.00	0.00
13	Perio/ear/ly	0.00	0.00	0.00
14	Perio/adv/zn	0.00	0.00	0.00
15	Perio/sever	0.00	0.00	0.00
16	Perio Absc	0.00	0.00	0.00
17	RecU/V Lesi	0.00	0.00	0.00
18	AMUG	0.00	0.00	0.00
19	TMJ Disorde	0.00	0.00	0.00
20	Peri/Coronit	4.00	80.00	0.22
21	Alveolitis	0.00	0.00	0.00
22	T. Frac. Mode	0.00	0.00	0.00
23	T. Frac. Seve	0.00	0.00	0.00
24	Tooth EV/Su	4.00	80.00	0.22
25	Oral Burn	0.00	0.00	0.00
26	S. T. Tr/mod	5.00	100.00	0.27
27	S. T. Tr/mod	15.00	300.00	0.82
28	Fac. Fract/mod	60.00	1200.00	3.22
29	Fac. Fract/sev	75.00	1500.00	4.11
30	Benign L/Ne	0.00	0.00	0.00
31	Malign. L/Ne	0.00	0.00	0.00
32	Orthodontic	0.00	0.00	0.00
33	Other	5.00	100.00	0.27
<hr/>				
	TOTAL	172.00	3440.00	9.42

\* X/1000 Troops supported/year

HIGH BATTLE CASUALTY ENVIRONMENT.

10000 TROOPS SUPPORTED: 20,000 X 1000

DENTAL FACILITY, TYPE 2 MISSION: MAXILLOFACIAL INJURY REFERRALS FOR O.S.

LEADER CODE	DENTAL CONDITION	INCIDENCE RATE *	#/FAC/YR	#/FAC/DAY
1	Caries/mod	0.00	0.00	0.00
2	Caries/adv.	0.00	0.00	0.00
3	Caries/seve	4.00	80.00	0.22
4	Def. filling	0.00	0.00	0.00
5	Def. CastRes	0.00	0.00	0.00
6	Def. RemPrM	0.00	0.00	0.00
7	Def. RemPrMo	0.00	0.00	0.00
8	Def. RemAcry	0.00	0.00	0.00
9	Def. RemCast	0.00	0.00	0.00
10	Occlusal Tr	0.00	0.00	0.00
11	Accretions	0.00	0.00	0.00
12	Gingivitis	0.00	0.00	0.00
13	Perio/early	0.00	0.00	0.00
14	Perio/advan	0.00	0.00	0.00
15	Perio/sever	0.00	0.00	0.00
16	Perio Absc	0.00	0.00	0.00
17	RecU/V Lesi	0.00	0.00	0.00
18	ANUG	0.00	0.00	0.00
19	TMJ Disorde	0.00	0.00	0.00
20	Pericoronit	4.00	80.00	0.22
21	Alveolitis	0.00	0.00	0.00
22	T.Frac.Mode	0.00	0.00	0.00
23	T.Frac.Seve	0.00	0.00	0.00
24	Tooth EV/Su	4.00	80.00	0.22
25	Oral Burn	0.00	0.00	0.00
26	S.T.Tr/mild	10.00	200.00	0.55
27	S.T.Tr/mod	30.00	600.00	1.64
28	Fac Fra/mod	120.00	2400.00	6.58
29	Fac Fra/sev	150.00	3000.00	8.22
30	Benign L/Ne	0.00	0.00	0.00
31	Malign. L/Ne	0.00	0.00	0.00
32	Orthodontic	0.00	0.00	0.00
33	Other	5.00	100.00	0.27
=====				
	TOTAL	327.00	6540.00	17.92

\* X/1000 Troops supported/year

#### 4.4 DISCUSSION

The computer screens displayed on the previous pages illustrate the output of what the research team of the Dental Studies Division feels to be a feasible computer simulation. The simulation was carried out in a rather crude fashion as part of this project. The details of listing the procedures, tasks, personnel time requirements, and materiel requirements were worked out only for one condition used in the sample simulation. Further development would entail a similar process for each condition listed in the TADDB.

Some elements of the data base need further study, i.e., the probability of delivering certain treatments for a given dental condition (diagnosis), the times used by members of the treatment team in each of the tasks and procedures, and the utilization of equipment, durables, and consumables in each procedure. All of the numbers used in the data base need to be submitted to consensus opinion of a panel to arrive at reasonable estimates.

It is the opinion of the research team that the medical models do not provide an accurate simulation of the maxillofacial treatment and completely omits the entire area of dental outpatient care. The organization which operates and maintains medical models, Operations Analysis Office of the Directorate of Combat Development, Academy of Health Sciences, US Army has advised the research team that any modifications in the definitions, incidence rates, and treatment resource information in the quad-service medical simulation models will require: 1. the approval of a quad-service, multi-disciplined panel of physicians and dentists; and 2. the direction to change from the Defense Health Council.

In November of 1983 the Dental Chief's Council of the three services was briefed on the concept of a dental simulation model, and it was decided that action should be taken to make further modeling a tri-service project. Since that time no further action has been taken.

#### 4.5 RECOMMENDATIONS

A working panel of three dental officers, one from each service, and an officer or contracted civilian with expertise in automated simulation should be tasked for a period of one year to coordinate an effort to reach consensus on the numbers to be used in a Theater Dental Data Base, to select appropriate data processing software and hardware to support the modeling effort, and to develop a Theater Dental Simulation Program to assist in future resource planning. They should be provided adequate office space, data processing support, clerical support, and administrative personnel. The panel should be able to tap specialist consultants in all three services for expert advise.

The resulting simulation model should be easily operated and maintained by dental officers. The program should be easily modified to accommodate differences among the three services, changes in concepts of operations, and refinements in data. It should utilize hardware and computer language which do not rely heavily on scarce data processing expertise.

An annual tri-service review of the model should take place so that each of the three services can share the modifications that each service has made and maintain as much standardization as possible.

The Dental Chiefs' Council should seek the endorsement and support of the Defense Health Council in the separate dental simulation effort.

#### REFERENCES

1. World Health Organization. International classification of diseases: Manual of the international statistical classification of diseases, injuries, and causes of death, 1975 revision, Volume 1 Geneva: World Health Organization, 1977.

## CHAPTER 5

### DISCUSSION

This paper does not claim to have presented a summary of all the literature available on dental care during military operations. Its purpose is to present and to organize only the information pertinent to constructing a dental simulation model. The literature which did not present quantitative data was reviewed by the research team, and it has contributed to an understanding of how the quantitative data fit into reality. Simulation is by definition not reality, and many details of reality were deleted so that computer simulation can deal with the characteristics of dental services which are important to planning.

At the time of writing this paper, the research has not resulted in the outcome of an operational model. It is hoped that the documentation of pertinent information on the content and structure of a feasible dental model, similar in structure to the medical models, will lead to a developmental effort. If this development does not take place, the paper is at least a presentation of information of value to those involved in combat development. The data collected have already found value in several field materiel developments, training development, and personnel authorization reviews.

Some liberties were taken in Chapter 1 with the definition of types of dental care in a theater. These definitions differ from those presented in the accepted doctrine, FM 8-26, entitled "Dental Services."<sup>1</sup> The development of new concepts of dental operation, underway at the Academy of Health Sciences, has recognized a lack of utility in the use of the definitions in Field Manual 8-26. Work load can be seen in the categories of Emergency, Maxillofacial, Maintaining/ Sustaining, and Comprehensive care, and concepts developers find the terms convenient for discussions of the organization of dental services in a theater of operations.

The most significant conclusion reached, concerning the distribution of dental emergencies among causing dental conditions, is that caries is the biggest enemy. An inspection of the reports indicates that caries-related conditions produce at least 50% of emergencies. Caries-related problems are probably largely preventable with interceptive treatment and preventive measures. The second greatest cause of emergencies is predictable considering the average age of the population at risk. Pericoronitis is consistently a problem, not only because it occurs so frequently but also because it presents more treatment management problems. Any dental fitness program should place emphasis on early diagnosis, interceptive treatment, and prevention of these two dental conditions.

The model presented in Chapter 4 is useful and feasible. There are, however, characteristics of realistic dental service in a theater which deserve attention and future refinements of the model may need to include these characteristics. The work load addressed in the model is that for the military population served. Civic action programs and treatment of prisoners of war have

always been important activities in military operations. Identification of deceased is not a doctrinally directed activity; yet reports indicate that assistance in this area will continue to be requested of the field dental service. General medical combat casualty care has historically been carried out by dental personnel and recently has been explored as a formal duty of dental officers during periods of high casualties. Transportation requirements for dental patients is of interest to planning efforts. Each of these characteristics can be incorporated into a model, creating a more complex simulation.

An important question left unanswered for the development of a dental simulation is that of specifying what is meant by maintaining and sustaining care. That is, deciding what dental conditions in the TADDB condition list can be omitted from treatment in a theater. For example, the authors find it comfortable to omit orthodontic conditions as a category of dental conditions. What dental procedures can we advocate as the most austere for inclusion in maintaining and sustaining care? Certainly gold foils seem appropriate for exclusion from the procedure list, but decisions must be made concerning the inclusion of porcelain crowns, overdenture procedures, etc. Inclusion or exclusion in the model should accompany a real-life policy concerning what should be done in the theater. These decisions placed in doctrine, i.e., a revision of FM 8-26, will give guidance to modeling. But, more importantly, it will assist combat developments planners. Each inclusion or exclusion has great impact on the type of supplies, equipment, and personnel to include in the Tables of Organization and Equipment (TOE). This drives all types of procurement.

These decisions should be very heavily dependent on the expected level of oral health of the troops which deploy to the theater. The rates of dental emergencies used in the proposed model are based on hypothetical planning factors. More dentally fit troops can be sustained with fewer procedures delivered in the theater. The study of troops deployed to the Sinai indicated that 67% of the dental emergencies could have been prevented if reasonable dental care had been provided to these individuals before deployment.<sup>2</sup> An earlier publication indicated that 75% of the emergencies were preventable.<sup>3</sup>

The status of oral health issue becomes a real life readiness question and should give direction to dental program priorities in the peacetime dental care system. The trade-off for more austerity in the theater is pre-deployment dental readiness/fitness programs. This price must be paid at the expense of training time. Combat arms commanders must be educated to the trade-off value of time lost in training versus lost time in combat. Troops less well dentally prepared prior to deployment will exact a heavy cost in time lost from mission as well as result in less effective troops (See Table 5-1). Reserve component units must address this issue, since rapid mobilization may not allow for time to improve the oral health status of reserves after the mobilization order is received. The number of new accessions to the military during a mobilization may also adversely influence the oral health status, since many will not have had previous access to dental care.

The decisions on what conditions and which dental procedures to include in maintaining and sustaining care should be made in light of the above variables. It would be helpful to the decision-makers to have some indexes of the oral

health status of troops. Two simple indexes of the oral health status of active duty units seem appropriate if they are used for the purpose of describing the oral "toughness" of troops rather than becoming just an administrative requirement to fulfill. The indexes are: the dental emergency rate for a unit (a true outcome measure) and the distribution of the soldiers in the unit according to the 1-2-3-4 dental classification recently implemented in AR 40-182.

It has already been mentioned that the data available on previous conflicts are inadequate in both quantity and quality. The emphasis on accountability and the requirement to justify planned resources bring sharply into focus the need to improve record keeping of an appropriate quantity and quality. The authors feel that there is a need to address theater of operations dental reporting as part of the planning for dental services. The TOE of a theater Medical Command (MEDCOM) authorizes a Public Health/Preventive Dentistry Officer (SSI 63H) as part of the Surgeon's staff. When doctrine is revised (particularly FM 8-26) the description of this position, to include his responsibility for establishing a reporting program should be included. To ensure that adequate data are collected, a dental officer experienced in population and management statistics should develop a plan for wartime reporting.

### 5.1 RECOMMENDATIONS

Based on the discussions in Chapters 3, 4, and 5; and the recommendations from Chapter 4, the following summary recommendations are made:

1. That further research be authorized by the US Army Surgeon General to refine the data needed for planning for and simulations of dental services in a theater of operations.
2. That the Assistant Surgeon General for Dental Services take action to implement the theater dental work load simulation project.
3. That oral combat fitness programs be developed for deployable units using the 1-2-3-4 dental classification system as a patient management/unit reporting/oral health status instrument and unit or installation emergency rate as a health outcome measure.
4. That a Public Health Dentist with experience in population and management statistics be tasked by the Assistant Surgeon General for Dental Services to propose implementing action on a wartime dental reporting program.

### REFERENCES

1. Department of the Army. Field Manual 8-26, Dental Service. Washington, DC: The Department, 1980: 1-1.
2. Teweles R, King JE. Impact of troop dental health on combat readiness. Submitted for publication Mar 1984.
3. Payne TF, Posey WR. Analysis of dental casualties in prolonged field training exercises. Milit Med 1981 April;146:265-71.

TABLE 5-1

## DENTAL EMERGENCY RATES' IMPACT ON UNIT EFFECTIVENESS

	DIVISION					Man Days Lost/Div 1 Year
	Incidence Rate	Strength (x 1000)	Days Lost			
Worst Case	234	x 16	x 5		=	18,720
Average Case	188	x 16	x 3		=	9,024
Best Case	142	x 16	x 1		=	2,272

**APPENDIX**

THEATER ARMY DENTAL DATA BASE CONDITION LIST

TADDB Code	Name and Description
01	<u>Caries, moderate</u> - caries in an unrestored or restored tooth which is limited in depth and extent so that the pulp is not compromised. This category includes teeth in which a direct or indirect pulp cap is used, but the prognosis of the pulp is good. It includes tooth fractures, defective fillings, or lost fillings which are secondary to caries but are not severe enough to threaten the health of the pulp. It excludes caries associated with a crown or fixed prosthesis. Symptoms may include sensitivity to cold. Prognosis of the tooth and pulp is excellent with restoration.
02	<u>Caries, advanced</u> - caries in a restored or unrestored tooth and in which the health of the pulp is compromised due to the depth or extent of involvement. This condition includes tooth fractures, defective fillings, or lost fillings which are secondary to caries and threaten the health of the pulp. Signs may include rampant extent of coronal destruction or radiographic evidence of periapical involvement. Symptoms may include prolonged discomfort to hot, cold, or percussion. The prognosis of the pulp is poor, but for the tooth and crown it is good with pulp therapy and restoration.
03	<u>Caries, severe</u> - non-restorable caries with or without pulpal/periapical involvement. This condition also includes root tips retained after carious destruction of crown and fractures which are secondary to caries and render the crown non-restorable. Prognosis of tooth is grave. Most definitive treatment is extraction.
04	<u>Defective filling</u> - deterioration, fracture, or loss of permanent or temporary non-cast restoration which is not severe enough to jeopardize the health of the tooth pulp. (Excludes restoration deterioration, loss, or fracture associated with caries. See CARIES-MODERATE, CARIES-ADVANCED, or CARIES-SEVERE.) Most probable treatment is restoration.
05	<u>Defective Cast Restoration</u> - deterioration, loss, or defect in a cast crown or bridge restoration with or without associated caries. (Excludes cast restoration associated with CARIES-ADVANCED or CARIES-SEVERE.) Most probable treatment is removal and replacement.
06	<u>Deficient Removable Prosthesis, minor</u> - deficiency of removable prosthesis which requires only chairside adjustment. For example, occlusal or tissue bearing area disharmony which requires adjustment.
07	<u>Deficient Removable Prosthesis, moderate</u> - deterioration, defect, or fracture of a removable prosthesis which can be corrected by minor clinic, laboratory, and/or chairside procedures. For example, repair of minor dental fractures, lost denture teeth, loss of tissue bearing area, or disharmony requiring chairside reline.

TADDB CONDITIONS LIST (CONTINUED)

TADDB Code	Name and Description
08	<u>Defective Removable Acrylic Prosthesis</u> - absence, deterioration, defect, or fracture of a removable prosthesis which requires (complete or partial) acrylic resin denture construction.
09	<u>Defective Removable Cast Prosthesis</u> - absence, deterioration, defect, or fracture of a removable prosthesis which requires (complete or partial) cast metal or cast metal plus acrylic resin combination denture construction.
10	<u>Occlusal trauma</u> - occlusal or incisal masticatory forces which are beyond physiologic tolerance of the pulp or periodontal ligament. This condition may be evident by pain, mobility, or sensitivity to temperature. Minor occlusal adjustment is the probable treatment.
11	<u>Accretions on teeth</u> - dental calculus (subgingival or supragingival), stains, and/or deposits, NOT associated with inflammation. Most probable treatment is prophy.
12	<u>Gingivitis</u> - acute or chronic inflammation of the gingiva not presently associated with clinically observable destruction of the periodontal attachment or with osseous recession. May have psuedo-pockets of 3mm. Most probable treatment is prophy, scaling, and/or root planing.
13	<u>Periodonitis, early</u> - inflammatory destruction of periodontal attachment and other periodontal tissues. Signs may include periodontal pockets of 4-6mm or less. Can be treated with scaling, root planing, and/or curettage, without the need for further surgical treatment. Prognosis of teeth is favorable.
14	<u>Periodonitis, advanced</u> - inflammatory destruction of periodontal supporting tissue to such an extent that periodontal surgery is required. Signs may include periodontal pockets in excess of 5mm. Prognosis is good to poor.
15	<u>Periodonitis, severe</u> - inflammatory destruction of periodontal supporting tissue to such an extent that the teeth are not adequately supported to withstand normal masticatory force. Signs include pockets in excess of 5mm, tooth mobility, and severe recession of periodontal tissues. Most definitive treatment is likely to be extraction. Prognosis of teeth is grave.
16	<u>Periodontal abscess</u> - localized, acute, sometimes painful infection of periodontal origin. Prognosis for resolving acute condition is good. Prognosis of tooth (teeth) depends on severity of associated periodontal situation. Most probable treatment is ultrasonic lavage or scaling and curettage.

TADDB CONDITIONS LIST (CONTINUED)

TADDB Code	Name and Description
17	<u>Recurrent ulcerovescicular lesions</u> - recurring ulcers of oral or peri-oral tissues, frequently presenting with pain. (Aphthous or herpetic ulcers). Treatment is palliative.
18	<u>ANUG</u> - acute necrotizing ulcerative gingivitis. An inflammation of the gingiva characterized by necrosis of the papillae, ulceration of the gingival margins, appearance of a pseudomembrane, pain, and a fetid mouth odor.
19	<u>Temporomandibular joint disorder</u> - myofacial pain, TMJ pain dysfunction syndrome, dislocation, subluxation, or other condition involving the temporomandibular joint. Treatment and prognosis vary depending on the exact nature of the condition.
20	<u>Periocoronitis</u> - acute inflammation of tissue area surrounding tooth. Pain is a common symptom. Most commonly associated with erupting third molars.
21	<u>Alveolitis</u> - infection of an extraction site (dry socket, localized osteitis).
22	<u>Tooth fracture, moderate</u> - a break in the tooth, not involving the pulp, with or without the loss of a portion of a tooth and primarily due to forces external to the oral activity. (Excludes tooth fracture secondary to caries. See CARIES-MODERATE, CARIES-ADVANCED, and CARIES-SEVERE. Also, excludes fractured teeth involved in maxillary, mandibular, or alveolar fractures).
23	<u>Tooth fracture, severe</u> - a break in the tooth, involving the pulp, with or without the loss of a portion of a tooth and primarily due to forces external to the oral cavity. (Excludes tooth fracture secondary to caries. (See CARIES-MODERATE, CARIES-ADVANCED, and CARIES-SEVERE. Also excludes fractured teeth involved in maxillary, mandibular, or alveolar fractures).
24	<u>Tooth evulsion/subluxation</u> - separation of an entire tooth structure from its supporting and attaching tissues, primarily due to forces external to the oral cavity. The tooth may or may not be completely out of the bony socket.
25	<u>Oral burn</u> - chemical or thermal burn of the intraoral or perioral tissues, frequently secondary to use of aspirin or other medication.

TADDB CONDITIONS LIST (CONTINUED)

TADDB Code	Name and Description
26	<u>Soft tissue trauma, mild</u> - mild oral or facial soft tissue abrasion, contusion, or burn which requires only palliative treatment.
27	<u>Soft tissue trauma, moderate</u> - oral or facial soft tissue wound, laceration, or foreign body severe enough to require suturing but not involving fractures of facial bones.
28	<u>Facial fracture, moderate</u> - closed fracture of a single facial bone. Treatment can be accomplished with closed reduction.
29	<u>Facial fracture, severe</u> - open or multiple fractures of facial bones. Includes all severe and complicated injuries. Includes removal of foreign body which involves facial bones.
30	<u>Benign oral lesion/neoplasm</u> - non-metastasizing, non-invasive lesions or tumors of the oral or perioral soft or hard tissue.
31	<u>Malignant oral lesion/neoplasm</u> - metastasizing and/or invasive lesions or tumors of the oral or perioral soft or hard tissue.
32	<u>Orthodontic condition</u> - dento-facial anomalies of jaw size, jaw-cranial base relationships, dental arch relationship, or tooth position.

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